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WESTERN AUSTRALIA.

GEOLOGICAL SURVEY.

BULLETIN No. 21.

THE
GEOLOGY AND MINERAL RESOURCES
OF THE
NORSEMAN DISTRICT,
DUNDAS GOLDFIELD,

BY

W. D. CAMPBELL,
Assistant Geologist.

Issued under the authority of the Hon. H. Gregory, M.L.A.,
Minister for Mines.

WITH A TWO-SHEET GEOLOGICAL MAP, FIVE PLATES,
AND 19 FIGURES.

PERTH:
BY AUTHORITY: A. CURTIS, ACTING GOVERNMENT PRINTER.
1906.

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TABLE OF CONTENTS.

PAGE
Prefatory Note 5-8
Introduction 9
History 10-12
Topography 13
Water Supply 14
Previous References to the Goldfield 15-19
General Geology 19-35
Economic Geology 35-37
Description of the Mines 38-117
General 117
Tables of Analyses 118-119
List of Mineral and Geological Specimens 120-130
Index to names of Places, Mines, Leases, Reefs, etc. 131

LIST OF FIGURES.

To face page
1.—Photo of Lake Cowan from G.M.L. 776, Celt 9
2.—Photo of Lake Dundas from G.M.L. 789, Belmont 13
3.—Photo of Dolomite Cliffs, Lake Cowan 21
4.—Section at Causeway Point 22
5.—Photo of Trig. Hill 24
6.—Section at Reef, Cumberland G.M. 26
7.—Plan of the Valkyrie Dykes 27
8.—Plan of Dolerite Dyke, Cumberland G.M. 29
9.—Photo of Quartzite Outcrop 33
10.—Photo of Conglomerate [5938] 34
11.—Photo of Lime Kiln, M.L. 1 37
12.—Section of Reef at Horizontal Winze, Desirable G.M. 38
13.—Photo of the Princess Royal G.M. 44
14.—Section of Reef, G.M.L. 878 77
15.—Photo of the Cumberland G.M. 86
16.—Cross Section at Shaft, G.M.L. 923 99
17.—Photo of the Admiral Togo G.M. 104
18.—Section of Trench, G.M.L. 765 108
19.—Photo of the Lady Mary G.M. 112

The present report embraces not only the work of Mr. W. D. Campbell, but includes a brief *aperçu* of the labours of other observers.

That portion of the Dundas Goldfield embraced by Mr. Campbell's work consists essentially of a series of metamorphic sedimentary rocks, estimated to reach a thickness, making due allowance for repetition by folding, of not more than 800 feet, which occupies a strip of country skirting the west side of Lake Dundas, and near the west side of Lake Kirk. Some of these ancient sediments appear, according to Mr. Campbell's observations, to have been permeated by secondary silica and oxide of iron, and are now in places represented by the bands of laminated quartzite and the very ferruginous jaspers, which make a pronounced feature in the field. These silicified bands have been indicated by a separate colour and symbol on the Geological Map.

Associated with the metamorphic sedimentary rocks (some of which are conglomeratic) is a large area of what Mr. Campbell has designated as amphibolite, and which appears to be interbedded with the former; as some of these are distinctly amygdaloidal, there seems very good reason for believing them to be ancient lava flows.

In addition to these amphibolites are a series of diorites and epidiorites, which seem to be interbedded with the sedimentary rocks and amphibolites in such a way as to suggest the possibility of their being intrusive sills and dykes. It has not, however, been found possible to separate the latter from the amphibolites on the Geological Map, hence all have been distinguished by the same colour and symbol.

There are also relatively small areas of mica and chlorite schists occurring in the field. These, which it has not been found possible to distinguish by a separate colour and symbol on the Geological Map, may possibly owe their origin to the transmutation of those igneous rocks which make up the larger portion of the surface of Norseman.

Another very important feature is the occurrence of a large number of quartz porphyry dykes which traverse the whole of the area mapped in a general north-east and south-west direction. They vary much in colour, are sometimes fissile, pyritous, and occasionally slightly auriferous. These porphyries, so far as has been observed, traverse all the formations developed on the field other than the metamorphic sedimentary rocks and the very persistent norite dyke which traverses the central portion of the area mapped in a general east and west direction. In all probability these porphyry dykes form the apophyses of the large granite mass which lies to the east of, and just outside, the limits of the area mapped.

There are in addition a few isolated veins and dykes of dolerite, one of which is seen crossing the reef at the 145 feet level in the main underlay shaft of the Cumberland Gold Mine.

The newest igneous rock on the field is the intrusive norite which forms an east and west range, varying from a mile to half a mile wide, and of which Trig. Hill B 23, near Princess Royal township, forms a part. This dyke extends in an uninterrupted line to North Norcott, about twelve miles to the eastward and for a considerable distance further, whilst to the westward it crosses Lake Cowan and extends far beyond the limits of the area mapped. This dyke appears to have no effect upon the gold contents of any of the quartz reefs it traverses, and, further, is not traversed by any quartz veins.

These older basic and acidic rocks of Norseman are very similar in their character to those which are largely developed in other portions of the Eastern Goldfields; and although the Norseman district affords no direct evidence as to their geological age, there seems very good reason to believe that they all form part of one and the same series.

The earliest observer in the district, Mr. S. Göczel (a former member of the Geological Staff), indicates on his geological sketch map of the Auriferous Region of Western Australia, the greenstones and allies of Norseman as being of Palæozoic Age, whilst the micaceous and talcose schists of the same district are referrred to the Archæan. Much more detailed work, however, in other portions of the State will be required before the age of these rocks can be definitely made out.

Two small fragments of a once more extensive formation occur on the western bank of Lake Cowan, near the John Bull Lease, and four small outliers south of the Queen of the West Reefs, near Lake Dundas. The formation, which at present occupies but a small area, consists principally of a dolomitic limestone with siliceous bands. The beds, which contain specimens of *Turritella*, *Pecten*, *Cardium* (or *Cardita)*, *Margellania*, and fragments of *Polyzoa*, are in all probability of comparatively recent geological age, and may possibly represent the inland extension of the strata which fringe a portion of the southern coastline of the State.

A very large portion of the Norseman District is occupied by recent superficial deposits, which, in the bed of Lake Cowan, attain a thickness of at least 377 feet. A very large development of laterite occurs over that portion of the field which is occupied by the ferruginous jaspers, etc.

Norseman has proved a good mining field, the auriferous quartz reefs being scattered over a very large extent of country. The quartz reefs trend generally north and south, and underlie easterly at an angle of about 45 degrees; those trending generally east and west underlie south at angles varying from 60 to 70 degrees. With one or two notable exceptions, the quartz reefs are mostly short and consist chiefly of white quartz with a relatively small proportion of pyrites, galena, with (in certain localities) scheelite and bismuth. Many of the reefs evidently carry rich chutes of gold.

Up to the end of 1904 the area embraced by Mr. Campbell's work has returned 266,004ozs. of gold, or at the rate of 1,019ozs. for every ton of ore treated. From the returns given *in extenso* in the report, it appears that from:—

	Ore crushed.	Gold therefron.	Rate per ton.
	tons.	ozs.	ozs.
Reefs in the Greenstone...	237,508·47	238,210·52	1·003
Reefs in the Metamorphic Rocks	23,505·63	27,794·08	1,182
Total	**261,014·10**	**266,004·60**	**1·019**

The recent superficial deposits in the Norseman District have yielded only a limited amount of alluvial gold, the total reported from 1899 to 1904 being 1,662·37ozs. In that portion of the report which deals with the mines (and which forms by far its greater bulk) the arrangement and description by lines of reef has been adopted, and the statistics prepared accordingly. The compilation of the Statistics of the Gold Yield has proved unusually troublesome, owing to the number of short-lived leases and quartz claims, in addition to the difficulty of identifying the localities from which the various small parcels of ore were obtained. In their present form, however, they give as complete a record of the gold yield of the different lines of reef at Norseman as is possible.

The report, with its accompanying maps and plans, was, on being submitted to the Minister for Mines, ordered to be printed for public information.

A. GIBB MAITLAND,
Government Geologist.

Geological Survey Office, Perth,
15th March, 1906.

FIG. 1.

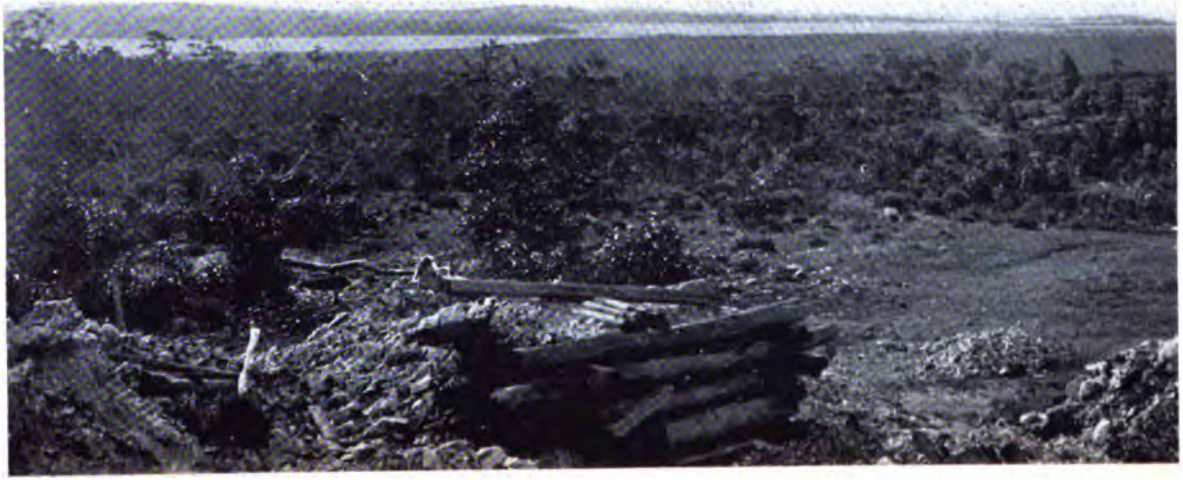

Photo., W. D. CAMPBELL.

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Lake Cowan from Ridge, G.M.L. 776 Celt, looking north-west to Causeway.

The GEOLOGY and MINERAL RESOURCES of the NORSEMAN DISTRICT.

Introduction.

The area comprised in the accompanying geological map of Norseman is that portion of the Dundas Goldfield lying between the southern end of Lake Cowan and the northern end of Lake Dundas, about eleven miles in a north and south direction and six and a half east and west, with the town of Norseman as a centre; it covers about 46 square miles, excluding the lake plains. The scale of the map is 20 chains to an inch, which is the smallest admitting of the essential details being shown. The map comprises contour lines, or lines of equal altitude at intervals of 20 feet, existing and extinct gold-mining and mineral leases, shafts and their depths where ascertainable, batteries, existing and proposed lines of communication, such as roads, railways, cycle tracks, and telegraphs, water rights, wells, tanks, and pipe lines, business and garden areas, as well as miners' homestead leases, together with the geological boundaries, in addition to the strike and underlay of reefs and dykes. The map is accompanied by an east and west section on a scale of 20 chains to an inch, in addition to the plans and sections of certain of the mines which have been reproduced on a scale of 100 feet to an inch.

The contours have been laid down by a combined tacheometrical and barometrical survey, in order to obtain the greatest expedition with accuracy.

The existing leases shown on the plan are those which were in force at the end of July, 1905, while the statistics of gold yield dealt with in the following report are up to the end of the year 1904, when the total yield of the whole Dundas Goldfield from mining was 247,560·26ozs. of fine gold and 3,162·88ozs. of fine silver from 283,106·38 tons of ore, or ·874ozs. of fine gold per ton, in addition to which the alluvial deposits yielded 1,662·73ozs. of fine gold. The total yield of gold tabulated in detail in this report is 266,004 gross ozs. from 261,014 tons of ore, a yield of 1·019 gross ozs. per ton, comprised as follows:—238,210·52ozs. from 237,508 tons of ore from reefs in the amphibolite area, a yield of 1·003 gross ozs. per ton, and 27,794·08 gross ozs. from 23,505·63 tons of ore from the banded quartzites and ironstone area, a yield of 1·182ozs. per ton. These latter figures represent the product of the reefs, etc., occurring in the area included in the accompanying geological map.

The total quantity of alluvial gold for the year 1904 is given by the Statist of the Mines Department as 109·91ozs. of fine gold, which, divided by the constant ·8419 (*see* table 6 of the 1903 Report of the Department of Mines), gives 130·55 gross ozs., which, added to the 6,799·12 gross ozs. of alluvial gold reported up to the end of 1903, makes the total 809·67 gross ozs. of alluvial gold from this field, or practically from the area mapped.

The compilation of the statistics of gold yield for the mines section have proved unusually troublesome owing to the number of short-lived leases and quartz claims, the majority being held by small parties of miners. There has been a difficulty also in identifying the localities from which the various small parcels of ore have come, in consequence of insufficient description, also the incompleteness of some of the older returns.

History.

The first indications of gold in the Dundas district were discovered by Mr. William Moir, of Fanny's Cove, in July, 1892, while searching for pastoral country. This gentleman found a few specks of gold in the alluvium of a small gully flowing into the west side of Dundas Lake. Mr. Moir, along with Mr. Thomas Stennett, organised a prospecting party to follow up this find, but failed to discover payable gold. It is interesting to note, by way of comparison, that it was in the following month of the same year that Messrs. Bayley and Ford reported gold at "Fly Flat," near the aboriginal rock-well "Coolgardie."

About the same time several other parties also started to prospect the Dundas Hills, which had been so named by Mr. Surveyor General Roe, in 1846. Of these parties, W. Mawson and R. Kirkpatrick were the first to discover an auriferous reef, which they called the "Maybell." This was at the south end of the Dundas Hills, and they obtained, at Southern Cross, a protection area, No. 293, which is identical with Dundas Reward Claim No. 1. Soon after the discovery of this reef, Bromley, Mason, and Desjarlais found a rich outcrop which they named the "Great Dundas," whilst Brodie, Kirtly, and Devine also discovered the "Scotia."

As these localities proved to be about ten miles outside the southern boundary of the Yilgarn Goldfield, which passed east and west about two miles southward of the highest hill (Woolyeenyer) in the district, a new goldfield called Dundas was therefore proclaimed on the 31st of August, 1893. This new goldfield comprised a strip about 50 miles east and west, and about 20 miles north and south along the south side of the Yilgarn Goldfield. The initial point of the description is Mt. Deans, the position of which was at that time thought to be nearly ten miles further south than it really is. The estimate of the area by Mr. H. P. Woodward, the then Government Geologist, who was appointed temporary Warden of the Dundas Goldfield, was 1,000 square miles. A few allotments for the site of the first township, Dundas, were laid out by Surveyor W. H. Angove, in 1893, adjacent to the Noganyer Soak.

Mr. Woodward was succeeded in January, 1894, by Mr. Arthur Hicks.

On the 6th of April, 1894, the south boundary of the Yilgarn Goldfield was altered to about 25 miles further north; and the Dundas Goldfield was given a length, east and west, of about 172 miles by 93 miles wide, the area being thus increased to about 15,996 square miles.

A discovery of a gold-bearing reef towards the northern end of the same ranges, between Lakes Cowan and Dundas, was made in July, 1894, by L. Sinclair, which he named the "Norseman." Another reef, the "Mt. Barker," was also found by Ramsay and party, who took up their lease on the 13th of August, the same time as Sinclair and party took up the "Norseman." These finds were followed by others, and the southern end of the field was eclipsed by what was known at first as North Dundas. The Mt. Benson was taken up by A. E. Stehn and party, on 23rd October, 1894, and the Lady Mary by Geo. Prout, on behalf of Geo. Brookman, on the 30th November following, and the Princess Royal by F. G. Chester and party, on 2nd May, 1895.

In consequence of this shifting of the population, the principal town, Norseman, was laid out about 15 miles north of the first townsite (Dundas), on the 29th of April, 1895. Both were gazetted on the 24th May, 1895, Norseman being further proclaimed a municipality on the 17th January, 1896.

On the 20th March, 1896, the description of the boundaries of the goldfield was altered, but apparently not the boundaries themselves, beyond excluding all townsites and fee simple lands within those boundaries; and in July following, the Warden's office was moved to Norseman from Dundas, although business had to be carried on until the end of the year in tents. On the 6th of May, 1896, the Coolgardie-Eucla *via* Norseman telegraph line was opened, and Messrs. Cobb and Co's. coaches began running to Coolgardie and to Esperance, a bi-weekly mail being established in August, 1896.

In May, 1899, Mr. P. L. Gibbons succeeded as Warden. On the 22nd of August, 1902 the width of the goldfield north and south was reduced to about 66 miles, making the area 11,500 square miles. This proclamation took effect from September, 1902, the description being :—

> "Commencing at the south-east corner of the Coolgardie goldfield, thence east about 42¼ miles, thence south about 66 miles, thence west 173 miles, passing through the 75-mile post on the Dundas-Esperance road, thence north about 66 miles to the south-west corner of the said Coolgardie goldfield, thence east about 132½ miles along the southern boundary to the starting point."

These boundaries exist at the present time.

In March, 1905, Mr. L. L. Crockett, the present Warden, succeeded Mr. Gibbons.

The population, according to the census of 1901, was 1,593, viz., 1,165 males, and 428 females. At the end of 1904, it is estimated that the population was 1,600, viz., 1,090 males, and 510 females.

There were 88 gold-mining leases in force at the end of the year 1904, with an area of 913 acres; of these only one, the "Break-o'-Day" of 24 acres, was outside the limits of this map, and of these 88 leases there were 46 held by companies and 42 by individuals.

A view of the town of Norseman appeared in the Report of the Department of Mines for the year 1900.

The following table gives the yield of the whole field up to the close of the past year, as shown (*a*) by the figures furnished to the Department of Mines, and (*b*) the Customs Authorities and the Perth Mint; this discloses the fact that 49,204·45 gross ounces have not been reported to the Department for reasons best known to the delinquents. The alluvial workings have not been extensive enough to have contributed much of this discrepancy. The 172 quartz, claims and 30 or more unregistered quartz claims, may have obtained a few hundred ounces of gold by dollying, but the bulk of the amount could hardly be materially affected thereby. While not venturing any further opinion on the matter, it is impossible not to recall to mind that there is lamentable and demoralising widely spread opinion among miners throughout the Eastern goldfields that the gold in any of the mines is as much the property of the miner, who is paid to work therein, as of the Company which employs him.

Yield of Gold from the Dundas Goldfield.

Year.	Ore crushed.	Gold therefrom.	Gold exported and received at Perth Mint.	
			Gross weight.	Fine contents.
	tons	ozs.	ozs.	ozs.
1893 ...	3,020·00	*a* 3,663·25	147·97	132·37
1894 ...			228·38	204·31
1895 ...			241·90	216·40
1896 ...			4,350·31	3,891·77
1897	16,882·98	*b* 17,115·65	19,310·81	17,275·36
1898	30,928·35	*c* 32,469·59	32,031·82	28,655·52
1899	59,379·30	*d* 37,839·28	45,164·95	40,404·36
1900	49,014·50	*e* 34,036·83	40,687·56	36,398·91
1901	38,373·00	*f* 29,843·03	38,796·25	35,163·62
1902	26,123·75	*g* 28,579·34	36,210·99	31,115·47
1903	25,953·00	*h* 33,845·76	41,553·90	35,217·41
1904	33,431·50	*i* 31,830·27	39,702·61	33,181·09
	283,106·38	**249,223·00**	**298,427·45**	**261,856·59**
			249,223·00ozs.	
Amount of gold not reported			49,204·45ozs.	

a Details not available. Prior to 1893 included with Yilgarn.
b Includes 68·42ozs. dollied and specimens.
c „ 4·94ozs. „ „
d „ 125·10ozs. „ „ and 122·17ozs. alluvial.
e „ 31·24ozs. „ „ „ 137·63ozs. „
f „ 143·83ozs. „ „ „ 502·02ozs. „
g „ 953·84ozs. „ „ „ 358·01ozs. „
h „ 691·94ozs. ore crushed and dollied (39,669·86 tons) and 424·04ozs. alluvial
i Includes 1,127·68ozs. dollied and specimens and 118·50ozs. alluvial. There was also 3162·88ozs. of silver obtained from ore.

FIG. 2.

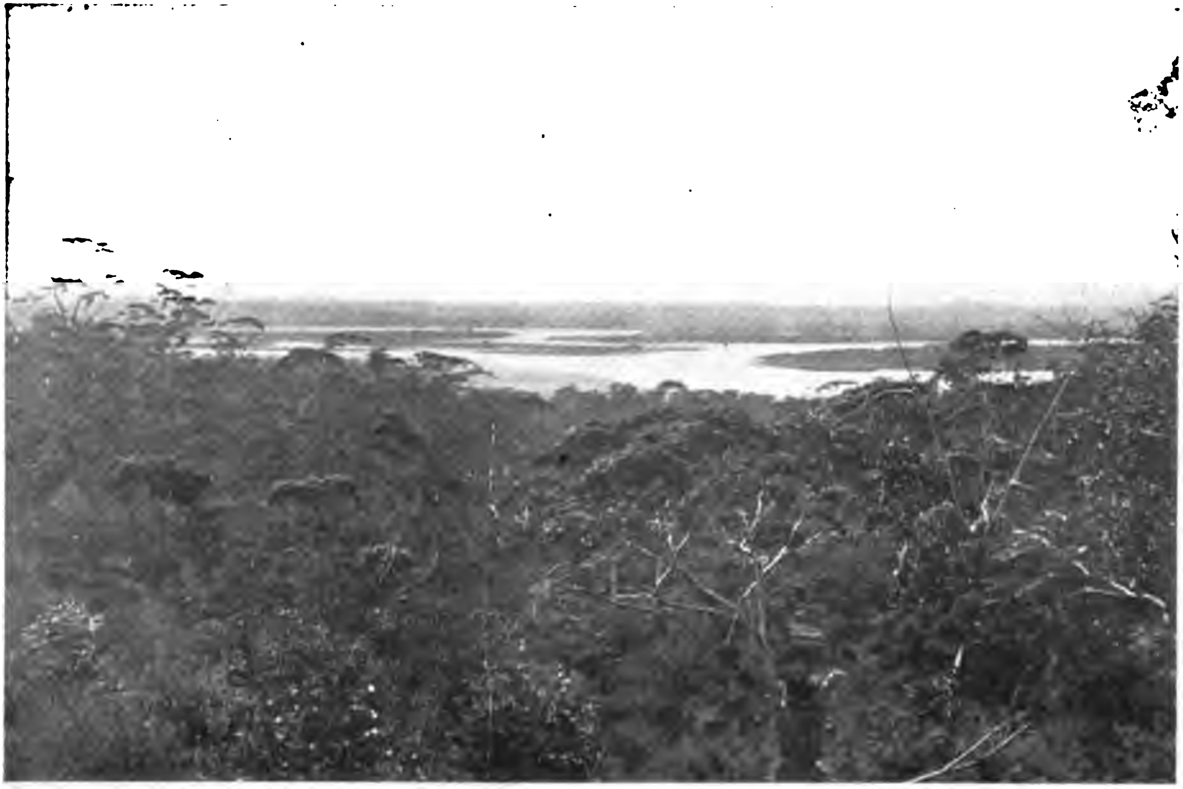

Photo., W. D. CAMPBELL.

Govt. Photo. Litho.

Lake Dundas, from Ridge, G.M.L. 789 Belmont, looking north-east.

Topography.

The area comprised in the map varies in height from about 845 feet to 1,580 feet above the sea level, and about one-half consists of well-wooded ranges of hills, trending slightly east of north. The principal exception occurs southward of the Princess Royal township, where there is a due east and west ridge. The height of the bed of Lake Cowan is 685 feet, while that of Lake Dundas, eastward of the Norseman Government tank, is about 20 feet lower than Lake Cowan. The wooded hills and extensive lake flats give a very varied appearance to the landscape (Figs. 1 and 2). The western shores of the lakes are mostly steep and rugged, while the eastern are mostly gently sloping ground. These lakes are dry during the greater part of the year; but in the driest seasons there is moisture at 3 or 4 inches below the surface in their central portions, the evaporation of which is the cause of the very conspicuous mirages that are continually to be seen during the warm portion of any bright summer day. Blown sand ridges and banks composed of fine particles of gypsum and sand are of frequent occurrence on the eastern borders of the lakes, and carry a scanty vegetation ranging from the so-called samphire plant (*Salicorina arbuscula*) to occasional gum trees up to about 20 feet in height.

The east and west ridge already mentioned is mostly covered with spinifex and a few scattered shrubs. This paucity of vegetation is caused through the scanty and silicious soil produced by the decomposition of the norite rock, being unsuited to the growth of trees. Almost all the other hilly country has an open bush composed of salmon gum, white gum, blackbutt and morell, ranging up to 2 feet in diameter. The whole of this is being gradually cut down for firewood and mining purposes, and unfortunately often in a very wasteful manner, many of the larger butts of the trees being abandoned instead of being split up, a practice which the purchase of timber by weight instead of by measurement would diminish greatly. It is satisfactory to see that the growth of the naturally sown young trees, judging by some of those tracts that have been worked over or had forest fires on them, appears to be over one foot per year.

The hills are rounded in outline, except along the banded quartzite and ironstones near the west side of Lake Dundas and Lake Kirk; there the ridges are steep and rugged, intersected at intervals by narrow gullies, with huge boulderlike outcrops of the banded rock; the tops of these ridges and spurs have, in places, rugged masses of laterite.

The meteorological observations taken at Norseman from the beginning of 1897 to the end of 1904 show a yearly average of 10·31 inches of rainfall, the lowest being 6·44 inches in 1899 and the highest in 1904, when it was 14·19 inches.

Eight observations were made for magnetic variation and dip by the writer, these are shown on the geological map. In the amphibolite area it ranged from 1·58° west and 21·87° south at

Norseman, to 3·06° west and 25·62° south at Princess Royal, while in the banded ironstone area it varied from 1° west and 21·12° south at the Government Tank to 6·16° west and 19·25° south at the Lady Mary G.M.; at the latter place there is a considerable amount of magnetite in the ironstone. Some samples which the writer found on the east boundary of this Company's ground were sufficiently magnetic to pull the compass needle right round the circle.

Water Supply.

The well water in the district is mostly either brackish or salt, the only exception occurs along the margins of the east and west norite ridge, where potable water has been found at W.R. 167, but the supply is limited. For analyses of this and other samples, *see* Table I., page 118.

The water from W.R. 168 is more saline, but both this and the water from W.R.'s 160 and 146 is used for stock. The reason of the saline character of the subsoil water is explained by Mr. Göczel, in his official report, which is referred to on a later page. The well water being inadequate for either boiler or battery purposes, and the mine water also, excepting that at the Desirable and Three Colonies, endeavours were made in the early period of the mining industry to obtain water from the lakes, as none of the mines were a greater distance than two miles from them, but it has not been found possible to obtain any supply by boring, and only a precarious one by collecting trenches. Trenches are, however, being used by the State Battery, the Mararoa, Cumberland, and Lady Mary batteries. Mr. E. S. Simpson, the Mineralogist and Assayer, discussed the use of brines in gold extraction in the Geological Survey Report for the year 1898 (*see* Table I., page 118).

The upper stratum in these lakes is largely a gypsum sand, but there is usually a clayey bituminous silt below this sand. The Public Works Department put down a bore in Water Reserve 3326, in the Norseman township, previous to 1896 and reached "diorite" at 165 feet; a small quantity of water was met with in this bore, scarcely sufficient to warrant more work being done; however, further prospecting subsequently located a permanent supply of salt water only 50 feet north of this spot, and a well of 127 feet was made which affords a supply of 4,000 gallons per hour. This well has been leased jointly by the State Battery and the Norseman Gold Mining Company.

In September, 1896, a bore was put down on the sand ridge about 35 feet above the lake, and about eight chains east of the edge of the lake, by the New Coolgardie Water Supply Company. Mr. W. C. Burkitt, who was in charge of the boring party, informed me that sand and clay were passed through, and water struck at 58 feet, in a band of ironstained rubble about three feet thick, and then sand and clay again. The country rock was met with at 99½ feet, and the bore was continued into it for seven feet. Another bore was put down in the lake about 17 chains from its edge, and about

29 feet from the edge of the ditch, by the same company. The manager, Mr. A. Mofflin, supplied the Department, in September, 1900, with the following particulars:—

> "Sinking was easy, through clayey material for 130ft., when soft rock with pyrites was met with till 175ft. was reached, and then soft bituminous mud, and at 300ft. a pyriteous bed and quartz; at 305ft. it changed to clay with pebbles and very hard slate until quartz was reached at 377ft. Water came within 9ft. of the top of the bore, but this could be readily pumped down, and the company then ceased operations."

The iron casing and plug now mark the spot.

In 1899, the Government constructed a large concrete-lined tank three miles from Norseman, near Lake Dundas, capable of holding 2,853,100 gallons at a cost of £16,955, from which water is pumped up to two iron service tanks near the Valkyrie G.M., from whence a supply pipe extends to Princess Royal, with a branch pipe to Norseman. This has now been found insufficient for the requirements, and auxiliary tanks are contemplated.

Previous Observations on the Geology of the Dundas Goldfield.

A brief reference is made to the goldfield by Mr. H. P. Woodward, the then Government Geologist, in his Mining Handbook to the Colony of Western Australia, published in 1894, p. 77; a second edition of which was published in 1895. He says on p. 111:—

> "The auriferous belt is narrow and seems to be the southern extension of the Coolgardie line, but south of this it has not been traced. There are three or four lines of gold-bearing reefs, but the gold-bearing stone rarely outcrops, so that a good deal of prospecting is necessary."

On page 38:—

> "The sixth, or second auriferous belt of granites, gneisses, and schists, lies next, and at present its width is unknown, but it is certainly considerable in places, and has been proved, wherever prospected, to be extremely rich in gold. It extends from the Dundas Hills (where this formation first outcrops from below the sand plains) by Wagemulla, Coolgardie, the Three Pinnacles, Ularring, Lake Carey, and following the same line as the other belts and turning with them to the north-west by the Nullagine, Marble Bar, Pilbarra, Egina, and Mallina upon the north-west coast."

About the end of May, 1893, Mr. S. Göczel accompanied a Government survey party in the capacity of Geologist, and made a trip to the Dundas Hills and their surroundings, and from thence *via* Mount Ridley to Esperance Bay, arriving there on the 25th September; his report appeared in the *ad interim* report of the Department of Mines for the half-year ending 30th June, 1894, Appendix 6, p. 36. He considered that the direction of Lake Cowan is along an old break in the Archæan strata; this break extending through Lake Lefroy, Lake Cowan, and the lake south of Dundas.

Mr. Göczel, in his report on "The Central Goldfields of Western Australia," on page 27 of the same publication, says:—

> "Of banded rocks the most generally represented on the goldfields are amphibolites—they overlay the gneiss sometimes directly and sometimes beds of quartzite, of syenitic gneiss, of mica, or of hornblende schist occur

between them—the upper strata of the amphibolites appear as chloritic schists. Of the massive rocks the older greenstones (diorites, diabases) and felsite porphyries are best represented. Beds of volcanic tuffs (greenstone and felsite tuffs) are abundant and extensive. Hill ranges, formed of striped ferruginous ribbon-jasper, indicate generally, lines along which breaks and dislocation have occurred. Those jaspers are the product of hydrothermal metamorphosis, over-heated waters, forming part of the eruptive magma, have forced their way into the pores and fissures of the adjoining amphibolites. By means of the introduction of silica, and complete re-crystallization of the original material, the mineralogical constitution of these rocks was completely altered. Those tuffs have been spread over wide areas by the waves of an ancient ocean, they consist of volcanic ashes, sands, lapilli, and the already described volcanic spherulites whose ejection was contemporaneous with the felsite porphry eruptions. In all probability submarine volcanic emissions have delivered their material to the ancient ocean, which, in its turn, has deposited them in the form of beds, following the deviations and depressions of its bottom."

On page 17 he continues—

"We meet with strata of the same section (Archæan), rocks forming basis sometimes overlaid by cappings and beds of ferruginous grits; sandstones and conglomerates which hardly ever attain any considerable thickness. These strata are more prevalent in the northern parts, chiefly in the Lake Cowan country and in the Dundas hills, on a relatively similar level, but at considerably lesser absolute height. In those parts of the country those strata are usually protected by overhanging greenstone formations and show their development in form of quartzite banks, conglomerates, shales, and phyllites. The old greenstones (diorite, diabase, gabbro), including the schistose and banded features (felspar—amphibolites, schists, etc.) form hills and ranges along gigantic breaks in the Archæan strata, they generally also indicate those stretches of country in which gold deposits occur. There can hardly be any doubt that the old greenstones are eruptive rocks of this palæozoic era."

On page 28, he speaks of the primary gold deposits, and attributes a hydrothermal origin to the quartz reefs, and on page 29 classes the lodes as single and compound—

"The latter are simply dykes, sometimes diorite or diabase, but chiefly felsite porphyry, containing small auriferous quartz lodes in their body. . . . . The lodes occurring in the dykes owe their origin to the contraction of the cooling magma, or in some instances to pressure, and the material which now fills them was introduced in solution; the former has usually massive quartz, and the gold occurs in ore columns, or so-called shoots of greater or smaller extent."

In regard to surface deposits he says, on p. 26:—

"The rock decomposes under the atmospheric influences, the schistose and tufaceous country absorbs the falling rain almost immediately, consequently the detritus of decomposition on the flat areas is not removed by surface waters; it often accumulates. The detritus of the country rock being almost entirely removed by wind, a continuous increase of the bulkier fragments takes place. The limit of that accumulation of quartz and ironstone is reached when the surface is covered with them, so that they form a cover of protection for the underlying detritus against the winds. Until that period, the surface of an area subject to such æolian surface accumulations recedes to a lower level, and the accumulated fragments receive in course of time, under the atmospheric influences, rounded and smooth surfaces. From the time when æolian denudation ceases, accumulative decomposition proper takes place; that is, the surface detritus increases at the expense of the underlying decomposing rock. This feature of decomposition is the one most frequently met with on the goldfield."

In regard to the inland salt lakes, he says, on p. 25, that:—

> "The salt is from the disintegration of rock forming minerals, with every rain new supplies of salt are carried towards the depressions. Besides chloride of sodium, or common salt, considerable quantities of carbonates, sulphates, and chlorides of calcium, magnesium, sodium, and potassium are dissolved and transported into the lakes. Here evaporation takes place. In water the point of saturation is first reached with sulphate of calcium or gypsum, and only later with common salt. At the beginning of dry weather the shores of the lakes are covered first with glittering crystals of gypsum before the efflorescence of salt appears. The gypsum banks along the shores of lakes gives us an idea of the quantities of material dissolved, transported, and redeposited by the waters. Those gypsum banks which we see are only the more recent products of the above process of nature, and much greater quantities are already buried by lacustrine sediments and loess. As evaporation progresses, salt is deposited at the bottom of the lakes, intermixed with sediments consisting of fine-grained argillaceous sand. The bulk of these sediments is blown by the winds into the lakes. Large areas, forming parts of the beds of shallow salt lakes, are repeatedly laid dry by evaporation, and their salt efflorescences appear on their surface. In dry and windy weather, salt and dust of such dry lake areas are scattered by the winds over the surrounding country, supplying its soil with a considerable quantity of salt. To the salt supplied in this manner, the extension of a saline vegetation far beyond the limits of the lake is due. The more easily soluble salts are deposited only by a complete evaporation, consequently only gypsum and common salt are generally met with."

Dr. Charles Chewings read a paper, entitled "Geological Notes on the Coolgardie Goldfields," before the Royal Colonial Institute on 17th March, 1896. This has already been summarised by my former colleague (T. Blatchford) in Bulletin No. 3 on the Geology of the Coolgardie Goldfield. On p. 5 he speaks of—

> "vast beds of conglomerates, interbedded with the schists and slates,"

and on p. 10, in regard to Norseman,

> "a great variety of dark-coloured schists and slates and crushed diorite have been here intruded into by the heaviest diorite eruptions I have seen on the field. While the reefs follow a north-south strike as a rule, and underlie in general to the east, this is by no means without exceptions. The country appears to have been much disturbed, and cracks were formed in all directions, and the reefs that now fill them also run in various directions. From what I saw I conclude the quartz reefs, almost without exception, carry gold; many of them are rich. Some are large and others small, and good specimens are occasionally obtained. A railway to this field is badly needed."

A topographical sketch map and geological section of the Norseman district was made and published in 1896, by James Parkinson, F.G.S., on an approximate scale of one inch per mile; this appears from a letter received by the writer from Mr. Parkinson was in the year 1896; the place of publication, however, is not stated. The plan showed a proposed loop tramline and branches, altogether about nine miles in length, extending from Messrs. Bevilaqua and Thompson's battery, which was the first battery erected on this goldfield. The tramline was laid out by Mr. Stirling Smeaton, C.E., and was for a two feet six inch gauge, and most of the earthwork had been made when the scheme fell through.

In the *Geological Magazine*, decade 4, Vol. 4, No. 398, p. 363, August, 1897, there is a paper on "The Dry Lakes of Western

Australia," by H. P. Woodward. He contends that the term "lake" is a misnomer, and that the lakes are merely large clay pans in valleys in high sand plains, and from these valleys rise steep rocky ridges consisting of hornblende schists, diorite dykes, and quartz reefs, which compose the auriferous series and that—

> "These valleys form the main drainage of the country, which falls in a south-easterly direction, but so gradually that the rain water, instead of cutting out a channel, spreads out in a broad sheet over the flat surface, thus forming, during a wet season, a series of large but extremely shallow lakes. The beds of these pans are for the most part composed of a thin layer of clay, which rests directly upon the upturned edges of the highly inclined decomposed schists beneath. In other cases the covering of clay is entirely wanting, the floor being apparently formed directly by the planed down edges of the indurated rock."

A pamphlet descriptive of the mines of the "Norseman Gold Belt" was drawn up and published by Mr. Arthur Catlin towards the end of 1899, from visits to the mines made between September, 1898, and March, 1899. His detailed accounts have been of considerable assistance in the present account, and, where used, acknowledgement is made.

Mr. H. P. Woodward also reported on the Dundas Goldfield in 1901, and it appeared on page 15 of the Annual Progress Report of the Geological Survey for that year. He states:—

> "There are about three distinct main lines of auriferous lodes, most of which dip at an angle of about 45 degrees, and vary considerably in size and richness. A very considerable amount of development work has been done upon them, and it is difficult to understand why some of them, which are undoubtedly payable propositions, should have been abandoned, whilst in some instances it is strange to find that so much money should have been expended upon such valueless lodes."

Of the former, he mentions the Desirable and No. 1 North Norseman. In regard to the Princess Royal Deep Lead, he says:—

> "The wash is a mottled clay, with ironstone nodules and rounded quartz pebbles, whilst the gold is often found in considerable sized pieces. The gutter is 90 feet in width, resting upon a decomposed schistose bottom, the eastern bank of which rises abruptly and the western gradually. This lead must be of considerable antiquity, as the slides that have taken place in the bed rock ore are often continued through the wash itself."

Mr. A. Montgomery, the State Mining Engineer, visited the Norseman district in 1903. His report is to be found on p. 53 of the Division 2 of the Report of the Department of Mines for that year. He refers to a local proposal to test the country between the Norseman easterly reefs and the laminated quartzite series, whose underlay converge together. In the latter formation, he says:—

> "The main veins of quartz seem usually to be parallel to the laminations of the quartzite, but the smaller ones are very irregular, and run in all directions through it. The quartz and brown oxide of iron carry some gold, and a good deal of work has been done in consequence, some of it with rather hopeful results. At first sight the impression is that the quartzites and jaspers are a belt of metamorphic rocks originally of sedimentary origin, and it may be that this is correct; but after examination of the very similar occurrence of jasper reefs at Boorara, Kalgoorlie, Edjudina, Erlistoun, and Black Range, I am of opinion that they are much more probably altered portions of the greenstone country, in which laminated structure

has been produced by intense pressure and shearing stress along a line or zone of faulting movement, and that the change of rock to quartzite and jasper has been effected by hydrothermal and pneumatolytic action (*i.e.*, by the action of intensely heated aqueous vapour) removing soluble constituents from the rocks and charging them highly in return with silica and oxide of iron . . . . and pyrites so as to make it now partake of the character of a lode." . . . .

And upon the Lady Mary deep lead he says:—

"Undoubted alluvial material was obtained, containing well water-worn stones, though mostly of a clayey character, and yielding encouraging prospects of gold. One fairly large nugget that had been obtained was shown to me, and was remarkably free from any sign of attrition by being transported by water, showing several sharp crystalline points. A lot of the fine gold was also crystalline and deposited in the faces of small crevices in clayey material and along minute rootlets of trees, which had penetrated down from the surface. The occurrence was quite similar to that of the gold in the well-known "pug" at Kanowna, to which some of the more clayey material bears a very strong resemblance. Some of the gold, however, was of the ordinary "water-worn alluvial character."

He considers the crystalline gold to have been dissolved and re-precipitated.

"With the exception of those in the quartzite belt, which are largely country rock infiltrated and partly substituted by silica, with ramifying quartz veins, the reefs of this district are composed of fairly clean white quartz, with a small percentage of pyrites. In places, however, the greenstone country rock itself has been highly charged with silica, and the values are in dark siliceous material similar to that so common in the lodes of Kalgoorlie. The walls of the reefs have usually well-defined, smoothed and striated surfaces, showing them to have been fissures on which movement of the country took place. They have every appearance of being permanent to any depth to which mining is likely to follow them."

General Geology.

The following table indicates the various geological formations occurring in the portion of the Dundas Goldfield embraced by the Geological Map:—

Superficial Deposits	Ironstone Gravel and Laterite Travertine Gypsum Dolomite.
Crystalline Rock—Amphibolite traversed by	Norite Granite Porphyries Quartz Reefs Felsite and Quartz Porphyries Dolerite Diorite and Epidiorite.

With interbedded

Metamorphic Sandstones and Conglomerates, with Banded Quartzites and Ironstone	Quartz Reefs and Lodes Felspar Porphyries Mica-diorite and Epidiorite.

The surface covering, excepting the hill tops, where the rock is usually bare, is concretionary ironstone gravel, which rests on kaolin in the flatter portions of the district; both result from the decomposition of the amphibolite, which is the predominating rock.

In the neighbourhood of the banded ironstones, the heavier residual particles left after decomposition of that material have re-combined as laterite, or concretionary ironstone [5613, 5967]. This laterite is found in all stages of solidification from stray patches to masses ten or more feet thick, forming cappings and fringes, chiefly on the eastern side of the banded ironstone ridges. It often weathers into boulder-like blocks having a dark rusty red colour, and these masses are often erroneously attributed by miners to volcanic action. Particles of gold are found sometimes in the centre of the ironstone nodules, or scattered throughout its mass; also occasionally fragments and pebbles of quartz, but the ironstone conglomerate does not contain fragments or pebbles of other rocks, being simply a residual concretion.

Kaolinized ground does not cover the country here to anything like the extent and thickness that it does at Kalgoorlie and further north. At the Princess Royal townsite, there is a strip of this material about a mile long and a quarter of a mile wide, which may be either a remnant of a wider covering or be due to the felsite dykes in this locality, being very susceptible to decomposition. In the south end of the patch the deep lead referred to later on was found. No particular age can be assigned to this kaolin, it is probably mostly decomposed rock "*in situ*," and has been increasing in depth as long as this has been dry land.

The alluvium covering the flat slopes of the eastern side of Lakes Cowan and Dundas merge at depths with the lacustrine deposits that fill up these immense lake basins; these deposits consist of dark bituminous silt and clay, which have been proved to have a depth of 377 feet. Some of the valleys and gullies that debouch into Lake Dundas have a considerable depth of kaolin. In the Lady Mary Gully a deep lead has been found, but only of small extent; other smaller gullies on the eastern slope have also gold in shallow gravel.

Associated with the kaolin and decomposed amphibolite rock is a thin calcareous incrustation of travertine, which is a calcareous residue or cement, resulting from the decomposition of the bed rock. This also occurs to a lesser degree on the norite area.

Crystals of selenite can be seen in the lake trenched banks, ranging up to five inches in length, whilst blown gypsum sand ridges are frequent along the south-eastern side of Lake Cowan, where it has accumulated through the action of the prevailing wind:—

The manufacture of salt by forming evaporating pans in the lake beds is quite feasible, requiring only the simplest procedure.

Fig. 3.

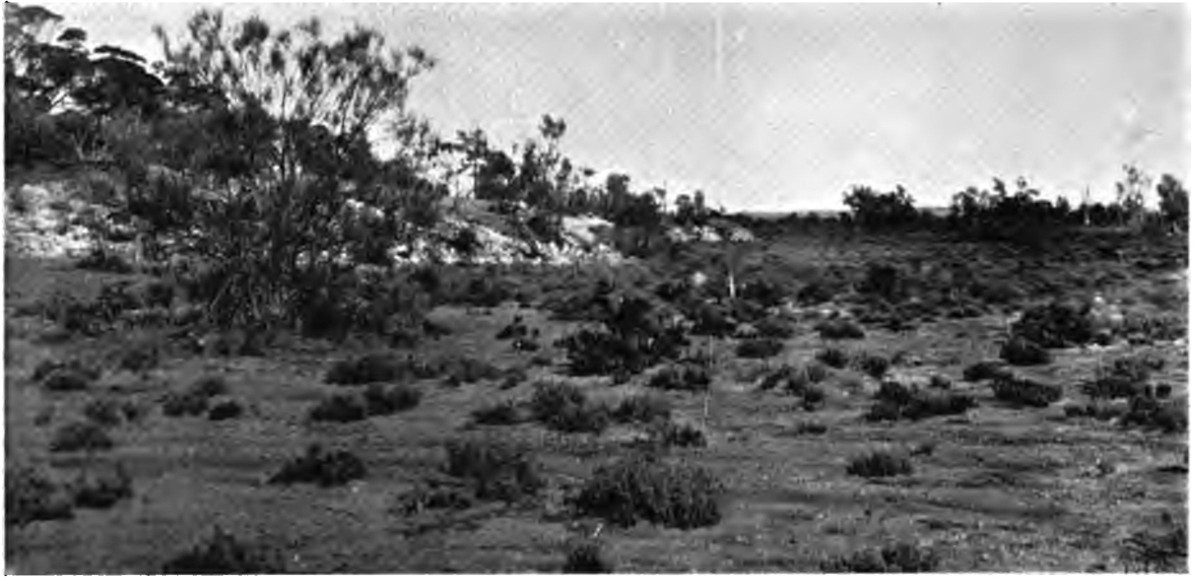

Photo., W. D. Campbell. Govt. Photo. Litho.

Dolomite Point, Lake Cowan, 1 mile north of G.M.L. 112, Golden Bottle, looking south.

A dozen miners' homestead leases have been taken up in the district during the last year or two, principally for growing wheat for horse feed. The experience in South Australia in districts with a similarly small rainfall shows that wheat growing is very precarious, but dairying is being successfully engaged in. Where the latter has been tried at Norseman it has also been successful. There seems to be a probability, judging from experiments that have been made, that both vines and fruit trees will grow in portions of this district and towards Esperance; the gravelly soil appears suitable.

Mr. E. S. Simpson, Mineralogist and Assayer, has supplied the following results of analyses of two samples of gypsum from Lake Cowan:—

G.S.L.	1568	1602
G.S.M.	5442	6131
Description	Powdery	Lump
Calcium sulphate, $CaSO_4$	67·28 %	64·95 %
Calcium carbonate, $CaCO_3$	3·96	2·10
Total lime, CaO	29·94	27·93

Pure gypsum contains 79·1 % $CaSO_4$.

Neither of these samples are suited for the manufacture of plasters owing to the presence of iron oxide, sand, and other impurities. They could, however, be used for agricultural purposes, for which their applicability in Australia is somewhat limited. Gypsum is chiefly used in agriculture for:—

(*a*.) Coagulating the colloids of heavy clay soils, and thus rendering them more friable and more easily worked. (*b*.) Converting the highly objectionable "black alkali" (sodium carbonate) into a far less harmful sodium sulphate. I do not think any of our land in the State contains an appreciable amount of black alkali. (*c*.) Supplying lime and sulphur, both plant foods, to the soil in a readily assimilable form. The great majority of soils already contain more than sufficient of these substances, whilst more are added in the form of phosphatic manures. (*d*.) Assisting in converting the alkalis of the soil into forms in which they can be readily absorbed by plants. Gypsum of high grade, used in small quantities for metallurgical purposes, is at present, I understand, being landed at the Fremantle smelter for about 15s. per ton.

Hillocks and long ridges of dolomite occur north and north-east of Norseman, and on the south margin of the norite rock at the mineral lease No. 1 at Lake Cowan (Fig. 3) and another area near the Israelite Bay track, near Lake Dundas. This last is, however, not within the limits of the map. Near M.L. 1, a portion of the dolomite has been silicified into flinty masses, varying in colour from grey and pale green to black. The dolomite is being quarried and burnt for lime at M.L. 1. It forms only an inferior kind of lime, but it saves the heavy cost of freight that would otherwise be entailed.

It seems most probable that these patches of dolomite have been formed by thermal springs, as they occur in places that are

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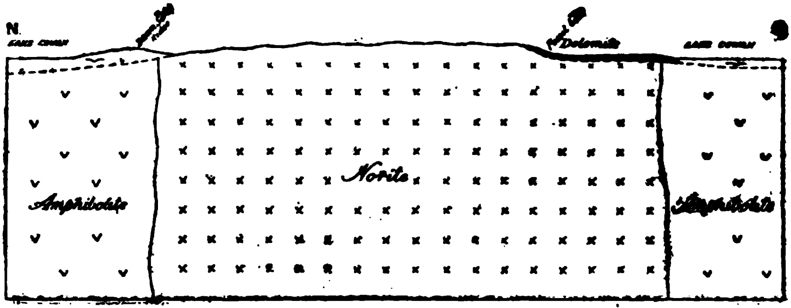
NOTE.—Since the above was put in type it has been found that a sample of a similar beach deposit [4679] was collected by Mr. J. B. Rankine in the year 1898, on the same side of Lake Cowan but 14 miles in a direct line northerly, and south-east of the Day Dawn, G.M.L. 129, showing the wide extension of these deposits.—W. D. C.

favourable to such an origin. The only other explanation would be that they are altered sedimentary limestone, through the action of water holding magnesia in solution, but no trace of any bedded character is discernible in the dolomite.

FIG. 4.



SECTION ACROSS NORITE DYKE & FOSSIL BED

About thirty chains north-east from M.L. 1 on the same patch, is a most interesting and as far as the writer is aware, unique opalized remnant of an old sea beach, at about 35 feet above the present level of Lake Cowan containing either late Tertiary or Recent marine shells, such as *Turritella, Pecten, Cardium* or *Cardita* and *Margellania* and numerous fragments of other shells, *Echinii* and *Polyzoa*; and the author would earnestly suggest that the locality be made a public reserve, so as to preserve this interesting relic from destruction. The best portions where the shells have been weathered out into relief having been, in the past, used for purposes of road construction. This old beach is the one solitary evidence as yet that the southern portion of Western Australia was in recent geological time 900 feet lower than it is now, and it is worthy of the State's protection.

Silicified specimens of what has been determined by Mr. Etheridge, the Curator of the Australian Museum, Sydney, as being true Eucalypti wood, occur on the valley flat of the Mary Cater Gully and on the laterite flat on the north side of Windlas Gully adjacent, both are north of the Israelite Bay track near Lake Dundas. In the latter locality, it occurs in a semi-chalcedonized matrix. This evidence bearing upon the history of Eucalypti in time is interesting.

Mr. Etheridge mentions that—

> "McCoy has described definite eucalyptus foliage from the older gold drifts (Pliocene?) of Daylesford in Victoria. Ettingshausen also has described several so called species of Eucalyptus from the upper tertiaries of New South Wales; viz.: Dalton, near Gunning and the main deep lead at the Vegetable Creek Tinfield, New England."

The writer was shown an obsidianite, or volcanic glass button, about ¾ inch in diameter, which was found on the surface of Lake Dundas, north of the Narracoorte Gully. Their occurrence is rare in this district.

The extensive tracts occupied by the lakes present an interesting study, and about which very little has been said and known, for until the few bores had been put down here and at Coolgardie, it was supposed that they were only shallow hollows. In W.R. 94 at Norseman, a bore situated about 1,100 feet from the edge of the Lake proved a depth of 377 feet of silt, and at Coolgardie 400 feet (*see* Annual Progress Report of the Geological Survey for 1900, p. 22). In the latter place there could be no outlet for running water at this depth, and there must be there, a rock basin 400 feet deep. Lake Cowan evidently is another rock basin, only of immensely larger extent. A considerable portion of the north part of Lake Kirk has a flat floor of rock that has been planed down horizontally showing the hard upturned edge of rock, with numerous veins of quartz traversing it; the surface is cleanly cut and undecomposed.

In regard to the origin of these rock basins, there is but one agent that could scoop out hollows such as these, and that is ice; in either the form of an ice cap over the whole country or by more local glaciers. This assumption is by no means an improbable one, it would be quite in keeping with the evidence of known ice grooving of rock surfaces in South Australia. There is proof of a great alteration of the level of the land having occurred here in recent geological time, in the old sea beach already described. It has moreover previously been shown that ice worn markings on boulders occur in the Gascoyne Carboniferous conglomerates which indicate glacial conditions (*see* Annual Progress Report of the Geological Survey for the year 1900, p. 28).

The prevailing rounded features of all this part of Western Australia would be quite such a configuration as would be produced by glacial action.

The distribution of the obsidianites over the face of the country appear to be very irregular, and appear to point to other sources of distribution than sub-ærial. That they are volcanic ejecta is self-evident, but their source is still a mystery. The author would suggest that their distribution has been largely by means of ice drifting from some antarctic region. The greater portion of the southern seas may have been at one time covered by ice floes, which would be coated with snow; this would afford a soft bed on which obsidianites would fall and cool, and the floes might then drift to and strand upon Australian shores; the ice would in time melt and deposit them there.

How long, in geological time, these superficial deposits have been accumulating we have no means at present of knowing; the planing down and shaping of the present surface of the underlying crystalline and metamorphic rocks has probably proceeded uninterruptedly throughout a vast stretch of time.

There is no sign that any great thickness of sedimentary strata ever covered those rocks, as is the case in the eastern portion of Australia. What are now on the surface are but the stumps of former mountains and dykes traversing the latter; the most recent appears to be the remarkable band of norite which forms an east and west range, varying from one mile to half a mile wide, and of which Trig. Hill B 23, near Princess Royal township, forms a part (Fig. 5). This immense dyke extends in an uninterrupted line to Mount Norcott, about 12 miles to the eastward, and further beyond that, while to the westward it passes to the other side of Lake Cowan. No intrusive rocks occur in this norite, which would thus appear to be the most recent of all in this district.

Three analyses of this rock are given in Table II. The structure and analysis of mineral specimen [**5646**] from the point at the east end of the Causeway shows it to be a change towards a hypersthenite, on the west side of Lake Cowan it is a peridotite on the south margin of the dyke. Mineral specimen [**5896**] from Mt. Norcott may be taken as typical of the norite; a section of this has been examined in the Departmental Laboratory, and is thus described:—

> "Coarsely granular, the most frequent mineral is a fresh multiple-twinned *plagioclase felspar*, almost wholly transparent, but a little cloudy in places, with numerous dusty inclusions mainly along cleavage lines. *Diallage* is the next most frequent, it occurs in large angular or rounded fragments, with well-marked schiller structure; colour pale green or smoky. Twinning occasionally gives rise to herringbone structure. *Hypersthene* occurs in large rounded grains with numerous dusty inclusions, and is intimately associated with diallage. It is faintly pleochroic, pink to pale green, with small marked changes at times. *Iron ores* are represented by a few small irregular grains and *hornblende* by a few small irregular fragments of green hornblende."

Mineral specimen [**5439**] from the road line west of Trig. Hill and [**5581**] from the bluff on the west side of Lake Cowan are very similar to this. In the former, portions of the diallage show a fringing of hypersthene, one being apparently in process of merging into the other. The examination of [**5646**] shows it to consist almost entirely of coarse granular hypersthene, and in the interstices are small pieces of felspar.

The next older in age probably are the granite-porphyries closely associated with the quartz veins, they appear to follow the same lines of fissure as the quartz reefs. Some of these granite-porphyries may be earlier and some subsequent to the reefs. In Mt. Benson No. 1 Extended, G.M. 52, it forms the eastern dyke, and is probably the dyke that is said to cut through the quartz reef; in hand specimen [**5985**] it appears to be a fine-grained whitish rock, with small black crystals scattered through it. The laboratory description states that it is somewhat coarsely granular and largely micro-pegmatitic:—

> "*Felspar* and *quartz* are in large separate individuals, surrounded by areas of same closely intergrown giving a pegmatite structure, felspar mostly untwinned, but some grains show single and others multiple twinning. *Biotite*—Numerous aggregates of small scales."

Another example of granite-porphyry occurs at the Italia, G.M.L. 165, near Lake Kirk [**6004**]. This is very dark in colour,

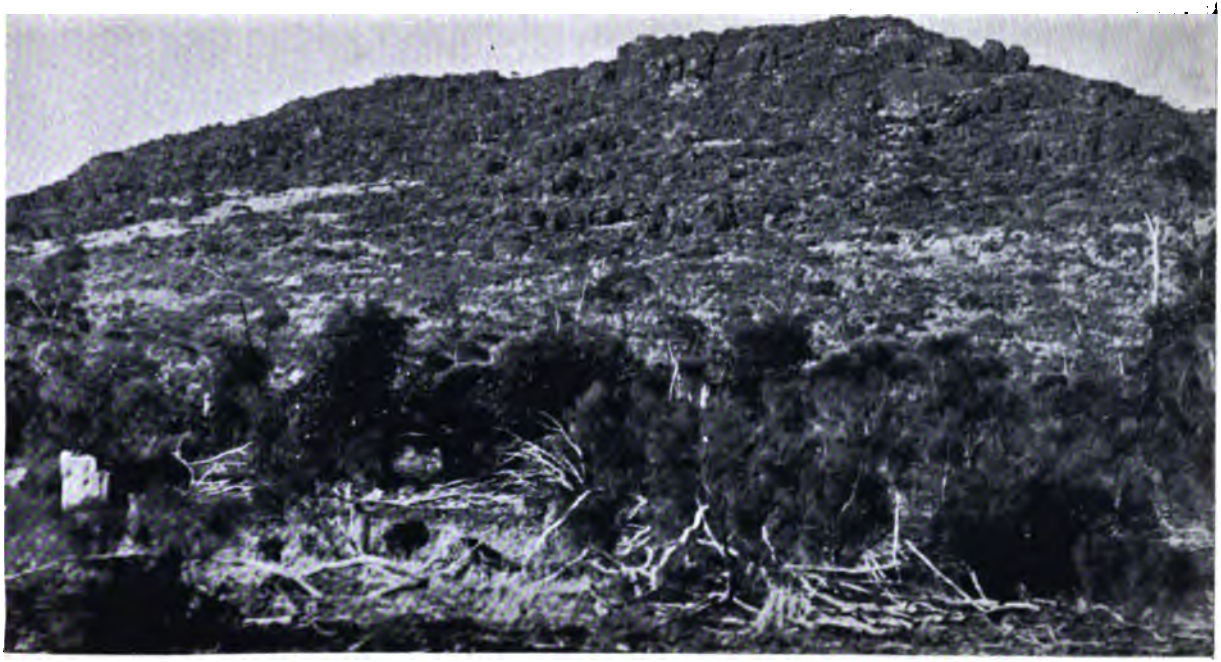


Photo., M. B. Woolcoc . Govt. Photo. Litho.

Trig Hill, Princess Royal, Norseman, view looking east.

almost resembling the amphibolite. The Laboratory description states it to be—

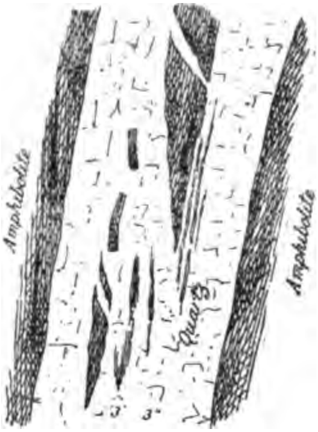
> "Probably a granite-porphyry, the felspar of which forms a finely granular base, but the species is indeterminable. *Muscovite*, coarsely fibrous, very frequent. *Biotite*, strongly pleochroic, pale yellow to deep brown, common in scales and fibres. *Iron ores* consist of irregular grains. *Quartz*, frequently interstitial. *Sodalite* (?), occasional large colourless crystals, isomorphic. Numerous inclusions."

What is probably a granite porphyry accompanies the quartz reef in Norseman No. 1 North, G.M.L. 16, in the 100 feet level, south of the main shaft, sometimes on the hanging wall and sometimes on the foot wall; it is there looked upon as an indicator of gold in the reef, the sample obtained was too much decomposed for determination.

The auriferous massive quartz reefs are scattered over a wide extent of country, including most of the area in which the quartz porphyry dykes and banded quartzites and ironstones occur. Intersections with the dykes are favourable for values. Usually the best defined wall is on the hanging wall side of a reef, also clay partings, and slickensides mostly occur on that side, as may be seen at the Lady Mary and St. Patrick G.M.'s; but where there is laminated quartz, it is generally on the foot wall side, as at the Northern Star. In the Norseman and several other reefs, a good deal of calcite occurs. In the banded quartzite and ironstone area, the reefs are often more chalcedonic and lode like, partaking somewhat of the character of the surrounding rock, which is to be expected. With the exception of the Norseman line of reef, which is about two miles long, the reefs are mostly short and vary greatly in mode of occurrence, some have well-defined walls, as at the Cumberland (Fig. 6) and Northern Star, and portions of the Princess Royal, while others have scarcely any or no walls at all, and are greatly contorted as if following the foldings of a plastic condition of the amphibolite rock as at the Desirable and Valkyrie G.M.'s and part of the Viking workings of the Norseman G.M. This may be explained by the condition of great pressure which must have prevailed at times when the reefs were formed, causing probably but little difference between infiltration and intrusion of the superheated siliceous liquid. It is also conceivable that, given pressure and heat, hydrothermal and molten deposits of silica may be identical and make possible a connection with gradations, which would include porphyry, between these reefs and veins and a deeper seated granitic source. The accompanying sketch (Fig. 6) shows how portions of the country rock are at times entangled in the quartz forming the reef.

The main quartz and lode lines approximate to the magnetic meridian and the chutes of ore approximate with the magnetic dip southerly; but notable exceptions occur at the Northern Star and Lady Mary G.Ms., where the chutes dip to the north. The deposition of ores is, possibly, if not probably, due to a considerable extent to magnetic action, so that the presence of magnetite should be highly conducive to the occurrence of gold, and this is what the writer has found to be approximately the case from Sawpit Gully to the south boundary of the map, though most magnetite occurs on the easternmost ridge, where, as yet, not much gold has been found. It is somewhat curious that the presence of magnetite in this district had not been previously observed.

FIG. 6.



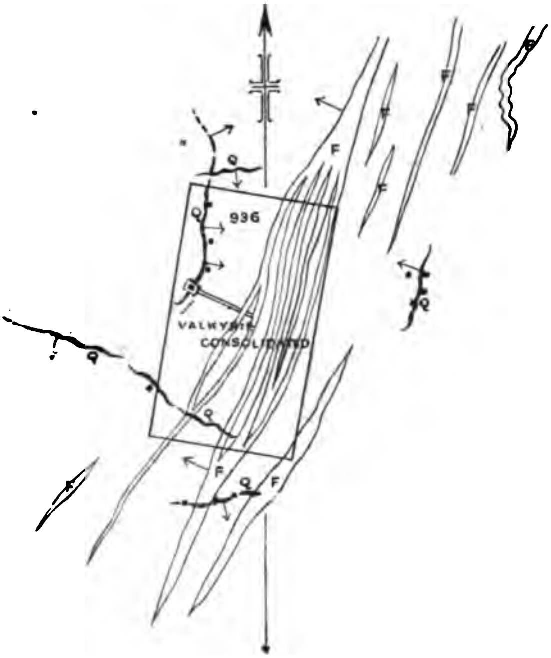
HALL'S REEF AT 850' LEVEL CUMBERLAND G.M

A very noticeable occurrence is the enrichment of the reefs when they pass through dykes: possibly, this enrichment is partly due to mechanical action, the interruption of the passage of ore material, but it is also, probably, partly due to the interruption of magnetic currents along the reef and dyke lines.

The special character about the reefs throughout the banded ironstone area is the way in which the gold is deposited at intersections with the ironstone bands. The iron has had such a precipitating effect that the surrounding kaolin has often been also heavily charged with the precious metal, forming a lode-like deposit, as at Ziegler's Find and Lucky Call G.Ms. Apparently, isolated patches of gold are characteristic of this line of country, and it would be in most cases too hazardous to attempt the excavation in bulk of a large body of these banded rocks on the strength of a few of these pockets of ore. The subject of reefs is discussed also in the economic geology section.

The injection of the molten material which formed the felsite and quartz-porphyry dykes in fissures in the amphibolite rock belongs to a date or dates anterior to the formation of the reefs, as the latter pass through them; these dykes show a remarkable parallelism and persistence over several miles' length of country, in a direction about 24 degrees east of north and vary from 2 or 3 feet to 150 feet in width, and are sometimes only 50 feet apart. At the Valkyrie mine they appear to divide up into a series of parallel dykes, which reunite again at a quarter of a mile distance (Fig. 7).

Fig. 7.



PLAN OF THE VALKYRIE DYKES.

The numerous felsite dykes met with in the workings of the Princess Royal show a green siliceous rock with a waxy lustre, which decomposes readily on exposure to the atmosphere. The laboratory description of specimen [6111] is :—

> " Micro-crystalline, with occasional porphyritic quartz grains. Quartz: A few coarse grains, with dusty inclusions; it is also finely granular in base. Felspar: Finely granular base, largely felspar. Pyrites: Occasional coarse, irregular grains. Iron ore: Some small sporadic grains."

The presence of these dykes is distinctly favourable to the deposition of gold where quartz reefs intersect them. An analysis of this felsite is given in Table II.

Quartz porphyry forms the greater number of the dykes in this district, the felsites being apparently confined to the neighbourhood of the Princess Royal. Both are locally termed quartzites, but this is incorrect, as they are not altered sedimentary rocks. Although these dykes must be far more recent than the formation of the banded quartzites and ironstones along the eastern margin of the area mapped, it is noticeable that they do not intersect them, and although their trend is oblique to that of the sandstones, etc., they become deflected to a more north and south direction, where they approach them, as if the latter were too pliable or tough to be cracked or fissured. The banded quartz porphyry occurs also mostly along this eastern margin of the amphibolite.

The quartz porphyries vary very much in colour, from white to black, but always exhibit glassy beads of quartz scattered throughout their mass. They are occasionally pyriteous and slightly auriferous. The laboratory description of specimen [**5969**], a somewhat slaty sample, being :—

"Typical quartz porphyry, having porphyritic grains of quartz and iron ore imbedded in a micro-crystalline base of quartz and felspar.

Mineral specimen [**5946**]. *Microstructure*: Micro-crystalline, a very little quartz is porphyritic, strongly banded, with occasional typical spherulites. *Felspar*: Very finely granular forming a large part of the section. *Quartz*: Slightly coarser grains, largely developed in bands and irregular lenses. *Hornblende*: Still more coarse, very numerous scattered fragments arranged in bands and clustered round spherulites. *Iron ore*: Sporadic.

Mineral specimen [**5612**]. Foliated, micro-crystalline, porphyritic with flow structure, round quartz grains. *Quartz*, in large porphyritic grains, with dusty inclusions, and in masses of very fine grains. *Felspar*, very finely granular, forms great portion of base.

Felspar porphyry occurs in a dyke near Lake Dundas about five chains east of G.M.L. 328, among the metamorphosed sandstones. The Laboratory description of mineral specimen [**5940**] being :—

"Structure—fine-grained, slightly porphyritic; weathered *felspar*, in porphyritic crystals and fine grains much clouded, no twinning. *Biotite*, deep yellowish greenish to pale yellow in scattered irregular grains. *Quartz* in small interstitial grains. *Iron ores* in fine grains.

At the eastern base of a hill about 2½ miles east of the Norseman Government Tank near Lake Dundas there is a large dyke of granite [**6034**] flanked on its western side by porphyry [**6029**], [**6032**], [**6033**] and then again by quartz porphyry [**6031**] which is crushed on its western side into a mica schist [**6030**]; the adjacent amphibolite is also crushed into a foliated and slaty condition; there is a small quartz vein in the schist; some prospecting holes and claim posts indicate that probably some traces of gold were found here. The granite appears slightly crushed, but the amphibolite, adjacent on its eastern side, does not show much sign of alteration. A quarter of a mile further east, on the other side of an arm of the lake, a large pegmatite vein outcrops.

The analysis of a sample of this [**6035**] shows it to be composed of almost pure quartz :—

S_1O_2	98·01
CaO	·44
K_2O	·13
Na_2O	·48
Al_2O_3	·82
	99·88

The quartz appears to be largely pseudomorphous after a soda-lime felspar, and shows zonary structure of felspar, *see* also [**6036**].

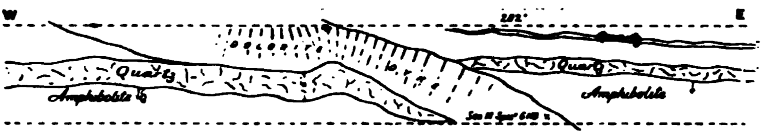
The cross section, comprising Plate V., shows this dyke. The laboratory description of a slice of the mineral specimen [**6029**] being as follows:—

"Structure—Coarsely granular quartz, felspar and biotite, with small crystals of zircon embedded in areas of fine grained quartz, felspar, and biotite."

An analysis of this specimen is given in Table II. The crushed samples of this rock show fractured crystals of quartz and felspar in a granular mass.

About the same age as the felspar porphyries probably were the various scattered intrusive veins and dykes of dolerite; a good sample was met with in the Cumberland G.M. at No. 1 level of the main underlay shaft, at 242 feet easterly, a sketch of which is shown below (Fig. 8). The dyke as an incipient form of columnar jointing so often assumed by basaltic rocks, which are merely a finer grained variety of this rock. Although the dyke passes uninterruptedly through the line of the quartz, the impression left in the mind after a careful inspection is that it is probably the older of the two, for the quartz on one side of it is in two smaller veins, as if the siliceous solution had found its way through the dolerite at some place and resumed its line of deposition of silica in divided portions. An analysis of this specimen [**6119**] is given in Table IJ. The laboratory examination of this rock is:—

FIG. 8.



SKETCH PLAN

DOLERITE DYKE CROSSING REEF 145' LEVEL MAIN UNDERLAY SHAFT CUMBERLAND G M.

Scale of Feet

"Structure—Micro-porphyritic. *Felspar*, in small lathe-like crystals, forming about one-half of the base. *Augite*, in small grains forming a large part of the base. *Ilmenite*, often altered to leucoxene, frequent in fine grains in base. *Olivine*, in large colourless porphyritic grains, very fresh, with fairly numerous fissures and inclusions. Sometimes twinned. *Hornblende*, a few green pleochroic and porphyritic grains.

The next class of rock to notice is diorite; its structure shows well developed crystals, showing that it has solidified under pressure, usually in dykes or horizontal expansions termed laccolites. In this district, however, it behaves mostly as large lateral sheets or flows which appear to be and were probably intruded while the amphibolite was in a semiplastic state, almost or quite contemporaneous with the amphibolite. The amphibolite must be the result of submarine eruption, as it is interbedded with the metamorphic sandstones and conglomerates and has a bedded and even almost slaty character in places [**5471, 5582, 5901**].

A diorite dyke [**5995**] occurs between the two quartz porphyry dykes at the Star of Erin G.M.L. 946, where it is noticably harder than the more decomposed amphibolite around. The Laboratory description is as follows:—

Hornblende, green pleochroic hornblende forms the greater portion of the section, in coarse crystals without regular arrangement *Felspar*, plagioclase in long slender multiply-twinned crystals somewhat frequent, as are also enclosures of hornblende. *Iron ore*, numerous small sporadic grains.

At the main shaft of the Princess Royal South Extended G.M.L. 647, two classes of rock are very noticeable, these junction near the bottom of the shaft; the finer grained one is diorite [**5471**]; it shows a flow character, having distinctly defined and rounded margin, it is considerably harder than the coarser rock, which is amphibolite. The Laboratory description of this diorite is:—

"Structure, finely crystalline (aphanitic). *Hornblende*.—Bright green hornblende forms the larger part of the rock in small interlacing crystals, with ragged edges penetrating the felspar and frequently fibrous in structure. *Felspar*, in small irregular grains between hornblende, and also in long, narrow, clear crystals with very low extinction angle, probably, therefore, albite, contains numerous small inclusions of hornblende. *Iron ores*, very many small irregular grains."

The intrusive veins [**5580**] that can be seen in the coarsely crystalline amphibolite at the foot of the hill on the south side of the clay pan about one mile north-west from Princess Royal are probably diorite.

A mica-diorite dyke occurs along the centre of the banded quartzite and ironstone south of the Bon Accord, G.M.L. 734, [**5942**]. The Laboratory description is:—

"Structure, finely granular. *Felspar* in finely granular masses. *Biotite*, small flakes of brown biotite singly or in aggregates, very numerous, strongly pleochroic, straight extinction in many fragments. *Quartz* in numerous small interstitial grains. *Iron Ore* mainly *Ilmenite* altered into leucoxene."

A few feet west of this sample the rock becomes a *Biotite schist* [**5961**]. The analysis is given in Table II. The laboratory description is:—

"Structure, finely granular. *Biotite* most common mineral, in small brown strongly pleochroic grains. *Felspar*, fine grains between mica. *Quartz*, a few interstitial grains. *Iron ores*, scattered grains of various sizes not very common."

Hand specimens of this and the previous and subsequently described varieties are, however, hardly distinguishable from each other. The western side of this dyke becomes a hornblende mica-diorite [**5962, 5963**], which weathers into a peculiar honeycombed surface. An analysis is given in Table II. The Laboratory description is as follows:—

"Structure, coarsely granular. *Hornblende*, strongly pleochroic, deep green to light yellow, in large crystalline fragments. *Biotite*, frequent in strongly pleochroic flakes, dark brown to pale yellow. *Quartz*, *Felspar*, and *Calcite*, numerous interstitial grains. *Ilmenite*, numerous irregular grains. The section shows a vein with quartz hornblende and zeolite?

Besides these diorites there are masses of rock which differ from the true diorites in that their hornblende is undoubtedly secondary, and probably derived from the alteration of a pyroxene, and are therefore classed as *Epidiorites*, but it is included in the same colour as the amphibolite in the map. Epidorite occurs at the Desirable G.M.L. 848 [5441]. The Laboratory description of which is:—

Structure—"Coarsely crystalline, strongly metamorphosed. *Hornblende*, large crystals, strongly pleochroic, bluish green to yellow, some singly twinned, some fibrous in structure, and almost all with feathery terminations. Also in felted masses of fine crystals, and in small crystals embedded in quartz and felspar, undoubtedly of secondary origin. *Felspar*, completely altered to a cloudy aggregate of secondary albite, epidote, etc. Numerous small enclosures of hornblende. *Quartz*, in numerous masses with ill-defined irregular boundaries of spicular hornblende, altered felspar, etc., and enclosing numerous spicules of the former, also irregular fragments of the latter, evidently secondary. *Ilmenite*, large skeletal crystals as well as small grains, which probably also include some magnetite."

Another mass of epidiorite forms the west boundary of Lake Kirk at the Sunbeam G.M.L 157 [5999]. The Laboratory description of which is:—

"Structure, coarsely crystalline. *Hornblende*, very pale, fibrous, and sometimes sheaf-like, with feathery ends; also in numerous embedded spicules, all undoubtedly secondary. *Felspar*, finely to coarsely granular, occasionally multiply-twinned; numerous inclusions of hornblende. *Quartz*, a little interstitial. *Iron ores* in large and small angular grains."

These epidiorites and their modifications are so greatly intermixed with the surrounding amphibolites that form the bulk of the country rock, that it has not been found possible to map their boundaries, they are almost certainly portions of the one rock mass.

A porphyritic diorite occurs at Buldania, a reference to which is given in a brief notice of that group of leases at the end of this section of the report.

We come now to the material of which the greater portion of the country rock of the district is composed, viz., AMPHIBOLITE. It assumes a great variety of forms; the normal type varies from coarsely granular to aphanitic, it is slightly amygdaloidal at the point north of the west end of the Causeway. It has planes of bedding that may be plainly seen in the cliffs of the islands and along the west side of Lake Cowan, underlying about 65 degrees to the west. In general character the rock is massive and occasionally slatey, as at the islands and cliffs previously mentioned. A schistose character is sometimes developed, where quartz veins and quartz porphyry dykes occur in their immediate vicinity; this foliation is always in the plane of the reef or dyke. A sample [5980] from the

300-feet level at the Cumberland main underlay shaft, a grey coloured rock, is thus described in the Laboratory examination:—

> "*Hornblende*, light green in large and small crystals. *Biotite*, numerous brown scales irregularly distributed and apparently replacing hornblende. *Felspar*, finely granular, interstitial. *Iron ore*, very numerous, large and small grains."

Another from about 200-feet level of the Lady Mary main underlay shaft [**5462**] is:—

> "Coarsely crystalline. *Hornblende* (Uralite) forms the bulk of the rock, in large sheaf-like bundles of pale green and yellow fibres. Undoubtedly secondary. *Iron ores* (Ilmenite and magnetite), in numerous large and small grains of irregular outline."

These descriptions are typical of the general character throughout each mine.

Another specimen [**5472**] from the Princess Royal South Extended, G.M.L. 647, has a coarsely crystalline structure:—

> "*Hornblende*, forms the greater part of the rock, in large crystals mostly very pale green, occasionally deeper green or brown. Some crystals, fibrous, and many with feathery terminations, also in areas of small felted spicules. Small inclusions of iron ores very numerous, hornblende almost wholly secondary. *Felspar* represented by relatively few irregular ores very much clouded through alteration. *Ilmenite*, many large fragments altered almost completely to grey transparent leucoxene. Much fine dusty black matter, which may be ilmenite or magnetite."

As a type of the aphanitic amphibolite, we may take that which forms a large part of the top of the high hill about two miles north of Princess Royal [**5448**]. The Laboratory description is as follows:—

> "Structure finely granular. *Hornblende* forms main bulk of rock in a mass of small interlacing crystals, pleochroic, pale green to yellow, probably secondary. *Ilmenite*, in large and small irregular grains, mainly altered to leucoxene. Secondary *Quartz*, felspar and probably *calcite* fills small interstices between hornblende."

An analysis is given in Table II. of the amygdaloidal amphibolite [**5650**] from north of the point at the west end of the causeway. The Laboratory description is:—

> "Structure, finely crystalline. *Hornblende* forms almost the whole of rock in radially fibrous spherules and interstitial masses, evidently secondary. *Iron ores*, in scattered, irregular grains. *Quartz*, a few small interstitial grains and veinlets, calcite ditto, also in amygdaloids (?)."

Sample [**5593**], from the cliff opposite the large island in Lake Cowan, is described thus:—

> "Structure, coarsely granular. *Hornblende* forms major portion of rock in large and small crystals, pleochroic, bright green to yellow. *Felspar* finely granular, interstitional, full of hornblende enclosures. *Iron ores*, very numerous, small grains. *Quartz*, a little interstitial."

Along the western side of Lake Cowan the amphibolite is harder than on the eastern side, more resembling the Buldania type; this is probably due to metamorphic action. This action has also induced a modification of the amphibolite, towards an actinolite rock, in places, chiefly between the quartzites. The Laboratory

FIG. 9.

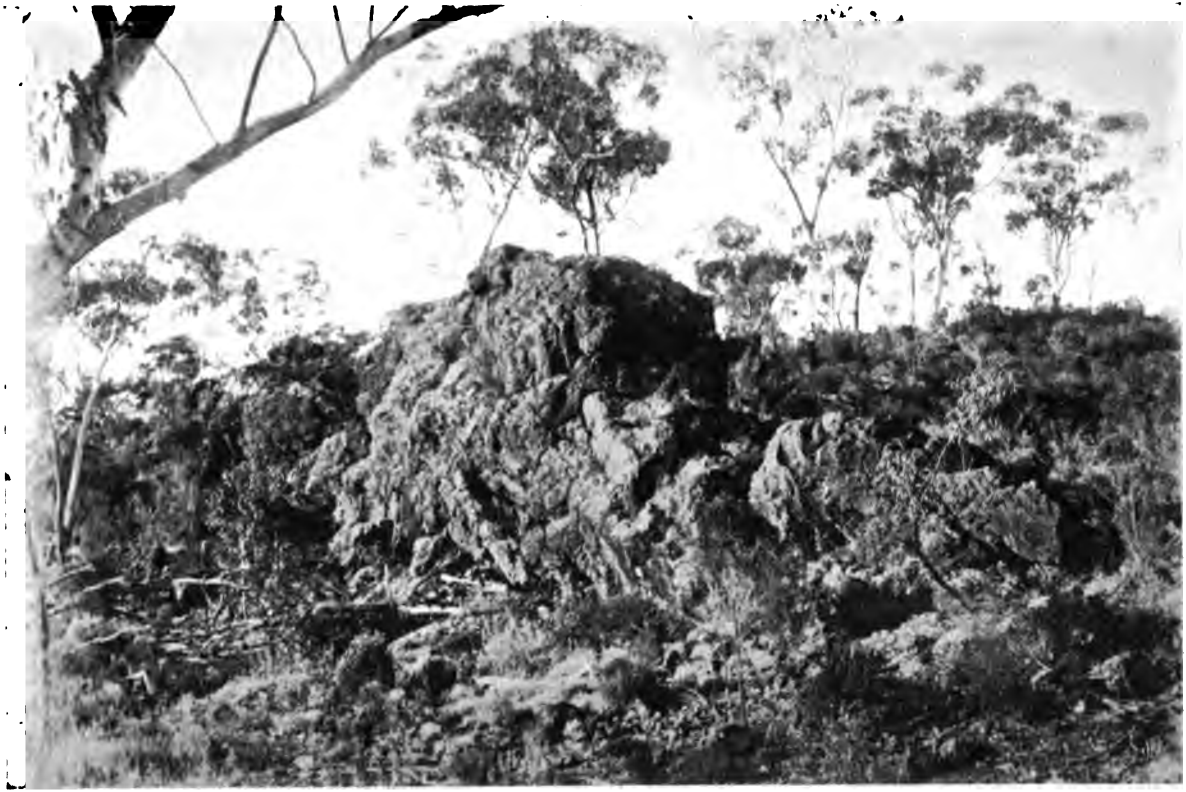


Photo., W. D. CAMPBELL.

Govt. Photo. Litho.

Banded Ironstone and Quartz Outcrop, G.M.L. 122, Florence, looking south.

description of sample [**5655**] from G.M.L. 104, north of the Lady Jean, which shows this change, is:—

> "*Hornblende*, large fibrous sheaf, like crystals, pale green and yellow, evidently secondary, altered in places to *Biotite* in small brown scales. *Iron ores*, large and small irregular grains. No felspars or quartz visible."

Another actinolitic sample [**5936**], from Bon Accord, G.M.L. 734, is stated to contain:—

> "*Hornblende* pale green and yellow pleochroic in interlacing fibrous crystals. *Biotite*, brown pleochroic scales frequent. *Muscovite* (?), present in colourless or pale green flakes. *Iron ore*, in scattered grains and granular aggregates common.

Another sample [**6021**], from the Lady Millar, contains:—

> "*Hornblende*, frequent in small fibrous crystals, pale green. *Biotite*, very common in brown pleochroic flakes, probably derived from the alteration of the hornblende. *Iron ore*, few small scattered grains."

Interbedded in these amphibolites there are a number of north and south beds of sandstone and conglomerates, the centres of which have been metamorphosed, chiefly by silicification and mineralisation, into a series of bands of quartzite and ironstone, sometimes jaspery; these occupy a strip of country about a mile in width (Fig. 9). A distinction has been made in the mapping between the slightly metamorphosed portions and the quartzites, but they were originally identical. The main core, so to speak, of quartzite is often composed of several subsidiary jaspery or ferruginous bands. They form a most diversified series of rocks, mostly ferruginous, occupying a strip of country about a mile in width, skirting the west side of Lake Dundas, and near the west side of Lake Kirk. The series of parallel repetitions of these quartzites may be explained by there being a folding of the strata by great lateral pressure, this is shown by dotted lines on the cross section plate. If this is the correct interpretation, then the metamorphic sedimentary beds may be not more than about 800 feet in thickness.

Near the norite dyke, the quartzites become also slightly crumpled by pressure applied in their longitudinal direction.

A peculiarity occurs in the quartzite of the ridge east of the Bon Accord, G.M.L. 734; the planes of bedding are here almost perpendicular, and it has in addition joint planes dipping 25 degrees north.

Throughout this series of beds, it has been already mentioned, quartz reefs and veins are frequent; these are of later origin than the silicification of the banded quartzites and are generally moderately auriferous and rich in places. There can be here no manner of doubt as to the sedimentary origin of these beds and their contemporaneity with the amphibolite; sometimes the banded quartzite and ironstone occurs in thin bands in the amphibolite, in which case the latter is usually actinolitic. [**5936, 6013, 6021**].

The metamorphic sandstones were possibly mistaken for tuffs and phyllites by Mr. Göczel, and the conglomerates are probably those to which Dr. Chewings alludes in his paper previously quoted.

Figure 10 shows a sample of this conglomerate from the Belmont, G.M.L. 789 [**5938**]; similar samples can be obtained from the west side of the Star, G.M.L. 835, about 30 chains north-easterly from the Belmont and also from numerous other places within the limits of this formation. The Laboratory description of specimen [**6129**], from Bon Accord, is—

"crushed conglomerate. Large fractured masses of *chalcedony* and *quartz* full of inclusions of limonite and other iron ores. *Ilmenite* partly altered to leucoxene, base largely composed of flakes of *biotite* with granular quartz and limonite."

Specimen [**6017**] is described as a—

"crushed sandstone. Quartz in large and small angular and irregular grains as well as in areas of crushed fragments, set in a fine grained base of quartz and felspathic material. *Limonite* frequently in globular masses frequently surrounding small black cores of magnetite (?), a grey and almost opaque mineral like *Leucoxene*. *Muscovite* in scaly aggregate.

Specimen [**6130**]—

"Quartzite. *Quartz*, very finely granular quartz (chalcedony) in large, irregular fragments due possibly to fracturing, the fractures or interspaces filled with more coarsely granular quartz. *Iron ore* pyrites in crystalline grains of all sizes frequent. A black iron ore, ditto. *Limonite* common.

This proof of the origin of the banded quartzites and the contemporaneity of sedimentary and volcanic products agrees with what the author has recorded in his field notes on the Kalgoorlie Goldfield, where the strike and underlay of both the banded quartz and slates coincide with that of the cleavage of the surrounding rock, usually 325 degrees, and an underlay of 75 degrees to the west, and that the argillaceous slates blended with the schists of the crystalline rocks. The cross section of the Boulder Belt, published in 1903, indicates the principle. The results of this Norseman survey are of great assistance in elucidating clearly many matters which were obscure at Kalgoorlie.

In the Norseman district, no argillaceous slates appear, but the quartzites are 1,500 feet in width in several places. The condition of these metamorphic sandstones and conglomerates evidently much resemble the metamorphic conglomerates of the Vermont formation at the Hoosac Mountain in Massachusetts, which have been found to pass gradually through stages of metamorphic conglomerates and quartzites, and gneiss-conglomerates into gneiss and granitoid gneiss (*see* Monograph, vol. 23, of the United States Geological Survey, p. 48), and from their similarity would seem to afford an indication of the origin of the extensive gneiss rocks of this State.

A two days' holiday visit was made to Dundas, 14 miles south of Norseman, where there is a considerable extent of granite, but it is probably also a later intrusion in the basic rocks. The Laboratory description of specimen [**5602**], from Noganyer Soak, is as follows:—

"Structure, coarsely granular. Quartz in large grains, with a few dusty inclusions and many extremely fine long crystals of Rutile (?). *Orthoclase*: Mostly untwinned and somewhat cloudy. *Microline*: Coarse grains

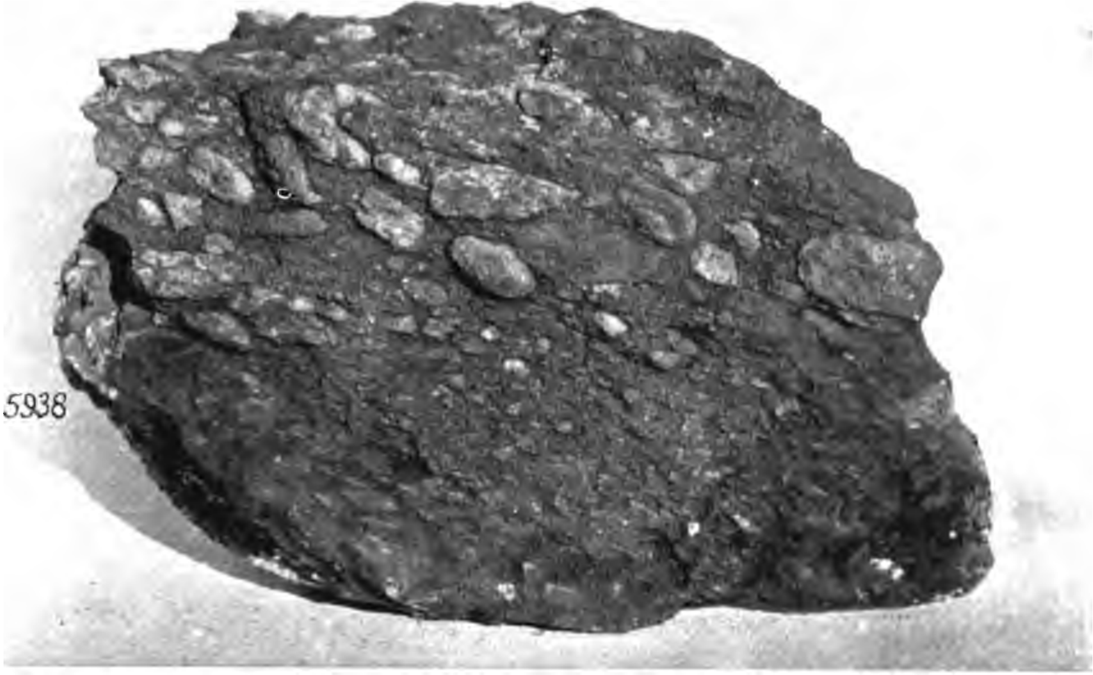


Photo., W. D. Campbell. Govt. Photo. Litho.

Metamorphic Conglomerate, G.M.L. 789, Belmont.

numerous with cross hatched structure under crossed ricols. *Biotite:* Numerous large irregular fragments, very strongly pleochroic, green or brown to black. Iron ore a little associated with the biotite."

The banded quartzites and ironstones skirt the edge of the lake the whole distance to Dundas. I was informed that there are also some southward of that place as far as a bluff at the lake edge about four or five miles south.

Quartz reefs and lodes appear at intervals throughout this distance, and groups of leases have been taken up along them, but nearly all have been abandoned for many years. Work was proceeding in a desultory sort of way at Mawson's Reward by dollying the best available stone. The reef has well-defined walls and a fair body of stone, and if a battery was available, it should do well. Since my visit operations at the Break o' Day have been renewed. The mine appears a good one. Whenever battery facilities are afforded this district, or a mineral tramway is made through it from the State battery at Norseman, it should be a profitable mining district.

Although Buldania, situated about 17 miles north-easterly from Princess Royal, was not within my instructions, a day's inspection of that part was made. The country rock appears to be amphibolite and diorite; some of the latter is porphyritic with quartzite and ferruginous formations, having quartz veins forming sulphide lodes and in parts intersected by quartz porphyry dykes. The rock is harder than at Norseman, and there is not more than about three feet of decomposed ground.

Gold was discovered here in June, 1896, and a strip of land about 1½ miles long was taken up in leases between that time and 1900—about 15 altogether—but they are all now extinct. A great many shafts were sunk to varying depths down to 100 feet. A few small crushings yielded very high returns, but the expenses proved too much for the limited capital of the leaseholders, mostly prospectors. Five distinct lodes are said to have been opened up; they are parallel and strike about 280 degrees. Mr. Catlin gives detailed descriptions of nine of the principal mines. One rock specimen from the Mia Mia G.M.L. 676 is peculiar, being a porphyritic diorite. The Laboratory description is [5927] is:—

"*Felspar* much clouded, in large crystals, no twinning, also a clear finely granular felspar between the larger crystals. *Hornblende*, well-formed crystals of all sizes numerous, pleochroism strong, pale yellow to deep green or brown. *Iron ores*, a few irregular grains."

Economic Geology.

The recent superficial deposits in the Norseman district have yielded only a limited amount of alluvial gold, the total reported from 1899 to 1904 inclusive being 1,662·37ozs. The alluvial workings are of small extent, and are mostly confined to some of the gullies trending eastward through the banded quartzites and ironstones. The gold is found at the base of gravel ranging from a few inches to 8 feet in depth. Narracoorte and Salvado's gullies have probably yielded the most gold; in both cases there was a considerable amount of laterite and ironstone gravel in close proximity to the gold patches; these had probably a precipitating effect on any gold in solution after its being dissolved out from the decomposing rocks and veins. The bottom is mostly banded ironstone and metamorphosed sandstone. Where the bottom is composed of concretionary material such as laterite and travertine (cement) it requires proving, in case false bottoms occur. The author was able to see only a few samples of the gold from here; it was of a shotty character, but it ranges from fine to nuggets of 3 to 4 dwts.

In February, 1901, the deep lead at Princess Royal was discovered by Messrs. Steadman, Sheppard and Cooper, these alluvial workings were mostly in the main street, and it was worked out in about six months. The depth was 88 feet in kaolin. Above the "wash" there is a white pug showing the usual slickensides and crush faces [**5475**], and above this in places there are ironstone gravel patches, technically termed "headings." The wash itself is mullocky, with concretions of a magnesian nature, with quartz particles, etc. [**5476**]. The gold was chiefly in the bottom of six inches of this and is probably partly secondary. This wash is said to have been 30 to 40 feet wide, and to have increased in thickness on the west side to about six feet, forming a kind of bank; most of the auriferous portion was on the side of this bank. Below this there is a gritty brown material, evidently decomposed hornblendic rock [**5477, 5478**]. The cap of a quartz vein three or four inches thick showed in some of the workings and oxidised amphibolite rock.

At the Lady Mary gully a deep lead was found at a depth of 90 feet in kaolin, adjacent to the existing watercourse, where it leaves the hills. There is a surface fall here of about 145 feet to the lake level. At 40 feet depth ironstone patches were met with, and at the bottom, which comprised kaolin and oxidised amphibolite, large boulders of quartz were found cemented in the pug and also black sand. The best gold was obtained where the large quartz occurred, and yielded about 12dwts. per ton. The last shaft where gold was reported was about 250 yards east of the first one. On the dumps of these shafts are to be seen large lumps of a secondary form of silica, pisolitic, ranging from earthy concretions to solid quartz [**6127, 6128**]. The sharp edges and absence of waterworn edges in some of the gold found here leads one to believe that some of this gold must be of a secondary origin.

The great area of ground over which the quartz reefs extend has enabled a large number of leases to be worked by parties of miners; they yield moderate returns with occasional rich patches. The main lines of reef are approximately north and south, with an underlay to the east of about 45 degrees, those bearing east and west underlay south about 60 to 70 degrees; this is in the amphibolite area. In the Cumberland and adjacent mines the reefs are often accompanied by "formation or gangue," caused probably rtly by chemical action and partly by crushing or attrition of the

FIG. 11.

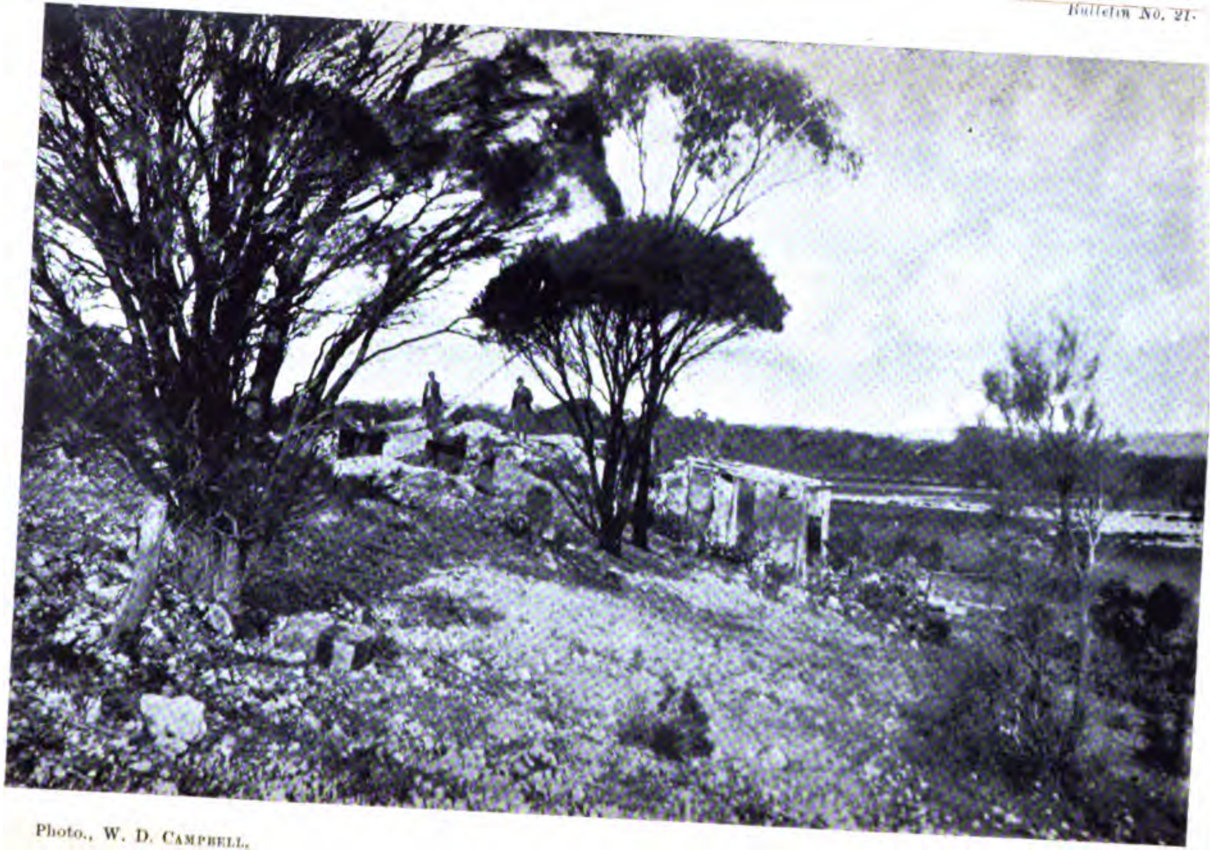


Photo., W. D. CAMPBELL.

Limekiln, M.L. I, Lake Cowan, looking south.

Govt. Photo. Litho.

sides of the fissure in which the reef has formed, subsequently, as it is sometimes brecciated. The intersections with felsite and quartz porphyry dykes is favourable to the deposition of gold in the reefs, as at the Princess Royal and Valkyrie G.Ms., probably due both to the arresting of the ore solutions and to interruptions of magnetic currents along both reefs and dykes. The chutes are sometimes of great length: the combined centre and southern chutes of the Princess Royal G.M. are 1,000 feet; the Mildura Norseman, 900 feet; Viking, 600 feet; and the Lady Mary, 1,200 feet.

The larger reefs have a considerable amount of either galena or pyromorphite, which contains silver. Galena, owing to its rapid oxidation at the surface, is seldom seen in outcrops, though it is stated to occur very near the surface at the Ajax at the end slope of the Norseman Hill, where there is very little decomposed rock, sulphide ore being obtained here at a shallow depth. Scheelite, an ore of tungsten [**5960**], occurs in the quartz at the Record, and appears as a dull brown sand in dollying or milling; it clings to the gold in panning off, as it is heavy. It is worth from £20 to £60 a ton if in sufficient quantities. It has been reported previously from the district, and if in sufficient quantity might be worth extracting from the battery sands. Bismuth is occasionally met with.

The quartz reefs which traverse the banded quartzites and ironstones sometimes coincide with their bedding planes, as at the Lord Hopetoun; they vary greatly in their character according to the nature of the rocks in which they occur, they frequently become dark and ferruginous and lode-like [**6023**] when they are in the banded ironstones; when in the quartzites they have frequently a chalcedonic character [**5933**]; this is a result of the segregation and infiltration of the iron and silica from those rocks. Iron appears to act as a precipitant to any gold in solution, which probably explains the erratic way that gold patches occur near ironstone which have yielded in places some extraordinary rich results, and the gold particles are in places clustered along the ironstone seams in preference to the quartz in the banded quartzite and ironstone lodes [**6573**].

A good many patches of a dolomitic limestone occur to the north and east of Norseman; on one of these is the mineral lease No. 1, where there has been erected a kiln (Fig. 11), which supplies an impure lime, which suffices for local requirements. The great cost of freight of such material, when brought from Fremantle, is quite prohibitive; the following is an example from the Princess Royal Mine:—

	£	s.	d.
8 casks at 13s. 6d. f.o.r., Fremantle	**5**	**8**	**0**
Railage to Coolgardie	**4**	**11**	**2**
Cartage from Coolgardie to Norseman at £9 per ton	**12**	**7**	**6**
Forwarding charges	**0**	**8**	**0**
	22	**14**	**8**

Description of the Mines.

The mines and reefs described in the following pages are taken in two groups, the amphibolite or basic and the banded formations or acidic, both begin with the north-westernmost.

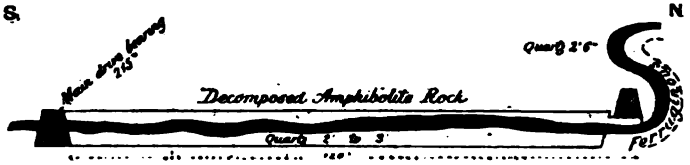
The first is the group of reefs comprising the *Desirable Proprietary* and the *Three Colonies* G.Ms. situated about one mile westerly from the Princess Royal township.

The Desirable Reefs.

The two main Desirable reefs have a curved outcrop, trending north-easterly, and about 1,000 feet in length; they sweep round towards the north-west and overlap at the centre; the general dip is to the eastward. The southern end of the outcrop enters what was originally the Little Pearl Lease, at a point about 140 feet south from the northern angle of the lease; the northern limit of the outcrop is in the old Missfire, G.M.L. 89.

The southern three-fourths of these lines of reef were held by the Desirable Proprietary G.M., which had seven leases with a total area of 76 acres. Both reefs had an inclined main shaft, which were about 100 feet apart at the surface but with divergent directions easterly, these are in the DESIRABLE No. 1, G.M.L. 84. The northernmost shaft is 230 feet on the underlay, equivalent to a vertical depth of 80 feet, the inclination being 30 degrees for the first 100 feet and then decreases to about 15 degrees below this. At the 90-foot level there is a drive 210 feet north with stoping to the surface, and 70 feet south; the width of reef ranges from 6 inches to 3 feet with an average of about 18 inches. The reef pinches out at both ends. The workings were not accessible below 150 feet, but Mr. Catlin's account states that at 160 feet a drive is 90 feet to the north, 130 feet to the south, whilst at 200 feet a drive goes 80 feet to the south and at this depth the reef gives out. The southern, or No. 2 shaft, is on a reef that overlaps the above described workings and the shaft has a more southerly direction, caused by the splaying of the two reefs. This shaft has an inclination of 35 degrees for the first 100 feet, and then 15 degrees below this, following the reef throughout. At the 70-foot level drives have been put in 50 feet north and 230 feet south. At the 100-foot level a drive has been carried 210 feet south. The average width of the reef is about 2 feet At the 125-foot level, which is equivalent to the 160-foot level of the other shaft (No. 1) drives have been put in

FIG. 12.



CROSS SECTION AT 125' LEVEL DESIRABLE G.M.

100 feet north and 400 feet south respectively. At about 300 feet from the shaft at this level, the reef becomes horizontal and a winze goes north for 120 feet along this flat reef, which then takes a sudden sigmoidal turn vertically. The diagram which forms Fig. 12 indicates this sudden change in underlie.

The main drive here has turned due west, and further on the reef gradually rolls over till it has a northerly underlay. These reefs have yielded up to 2ozs. per ton in places, and at 400 feet in this 125-foot level the lessee stated that its value is about 15dwts. per ton.

In the shaft (No. 2) it was found that the water stood at about 160 feet, so that I have to refer to Mr. Catlin's description again for information. At the 180-foot level there are north and south drives of 170 feet and 100 feet respectively; this depth is about the same as that attained by the north shaft. A vertical shaft connects the bottom of the shaft with the surface. Nearly the whole of the workings are in the oxidised zone of epidiorite rock. Alternate bands of oxidised rock and kaolinized rock occur parallel with the reefs throughout the mine. The quartz has a good appearance; it is in places vuggy, but all the interstices are filled with Halloysite, or Mineral Fat, a hydrous silicate of alumina in a plastic state [**5618**]. An analysis of this is to be found in Table II. The presence of this mineral is detrimental to the ready extraction of the gold during amalgamation.

The northern end of this line of reefs was in G.M.L. 89, the **Missfire**, held by the Three Colonies Gold Mining Company, which put down both a vertical and an underlay shaft on it; according to Inspector Angove's report, the former, which cut the reefs at 25 feet and 52 feet, attained a total depth of 55 feet, the reefs being four feet and three feet thick respectively, the latter reef being made up of quartz and ironstone. He also states that a second shaft, 56 feet in depth, passed through two good quartz reefs four feet and three feet in width, at depths of 25 and 52 feet respectively, and that a drive 80 feet was put in on the reef at 25 feet. A third vertical shaft of 56 feet in depth evidently passed through nothing but country rock, as there is no record of any reef being struck in that interval. An underlay shaft had also been carried down to a depth of 38 feet on a quartz reef, which varied in thickness from 18 inches to four feet. The crushings from this reef were merged into those from G.M.L. 88.

The other leases held by the Desirable Proprietary Company have not had much work done in them, excepting **Desirable South**, G.M.L. 168, where two shafts have been sunk on parallel reefs; but these reefs, however, are not the same as the Desirable main reefs, unless separated by a fault.

In **Desirable** No. 2, G.M.L. 85 two shafts have been carried down to a vertical depth of 120 feet on a reef about 18 inches thick; they were all inaccessible at the time of my visit. The Company is stated to have spent £30,215 on the mine. The two leases previously mentioned were forfeited in 1901, and subsequently became

Q.C's. 87 to 90, held by Mr. Hopper for about three months during the same year; subsequently, the ground became in part **Little Pearl**, G.M.L. 842, of six acres, which was surrendered in February of 1902; it became also, towards the close of 1901, in part **Desirable**, G.M.L. 848, of six acres. Upon this lease another vertical shaft was sunk to 50 feet, near the east boundary, cutting a quartz reef of nine inches on the top of a roll of the hard, undecomposed, coarsely, crystalline epidiorite. This lease and G.M.L. 870 were purchased by the Princess Royal North Gold Mining Company in 1904, and is still in force.

A portion of 842 became the **Desirable Extended**, G.M.L. 870, in 1902, and comprised three acres, and is still in force.

The ground on the east side of these was taken up as the **Subsidy**, G.M.L. 891 of 18 acres, and having been forfeited in 1904, subsequently became the **Desirable Block**, G.M.L. 915, which is still in force.

The following table shows the yield of the Desirable Reefs, in so far as such can be gathered from the official statistics:—

Table Showing the Yield of the Desirable Reefs.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
Previous to 1897	Desirable 84, 85, 152, 168, 196, 228, 229	...	795·00	...	...	1,306·00	
1897 ...	Do.	...	2,921·00	...	...	2,154·57	
1898 ..	Do.	...	857·00	...	...	163·56	
1899 ...	Do.	...	32·00	...	...	294·13	
					Extras	6·96	
1900 ...	Do.	...		...	...		
1901 ...	Q.C. 87-90	...	116·00	...	...	91·57	State Battery.
1901 ...	Little Pearl 842	..	11·00	...	...	5·60	
1901 ...	Primrose 845	...	4·00	...	...	2·45	
1902 ...	Do.	6·00	22·00	...	...	6·85	
				8·00	1·03	...	State Battery.
1903 ...	Rescue 875	...	13·00	...	...	5·28	
1902 ...	Desirable 848	...	50·00	...	...	23·75	
1903 ...	Do.	...	87·00	...	...	48·49	
1904 ...	Do.	...	277·00	...	...	62·38	= 52·11 F.
1903 ...	Q.C. 148	...	12·50	..	...	3·57	
		6·00	5,197·50	8·00	1·03	4,175·16 1·03 6·00	
						4,182·19 or ·804 ozs. per ton.	

The Three Colonies Reef.

The **Three Colonies Reef** has a somewhat semi-circular outcrop of about 500 feet in length, and underlaying irregularly to the north; it outcrops on G.M.L. 88, **Three Colonies**, and is situated about 300 feet north from its southern boundary. It has been exploited by four shafts the positions of which are shown upon the Geological Map. An underlay shaft intersected the main reef at about 30 feet from the surface which depth marks the water level in the mine, from this point the reef was followed down to a depth of

85 feet to the north-east. The reef attained, it is said, the thickness of about three feet and carried a little gold. A main vertical shaft, situated a little over a chain north from the last and about 100 feet from the nearest point on the outcrop, failed to reach the reef as the Wellington force pump used is stated to have been unable to cope with the water. At 70 feet there is a crosscut west to connect with the underlay shaft previously alluded to, and at 37 feet a quartz reef was met with; altogether three reefs were cut, said to be one foot, two feet, and 18 inches in thickness respectively; about 130 feet of driving was done on the middle reef to the north, and about 160 feet to the south. The dump shows massive diorite with some slaty bands which probably are near the reef [**5444, 5445**]. Near the north end of the lease there is a flat reef where there is an open cut. South of the main reef there is a small vertical reef about nine inches wide with an ironstone and quartz breccia on the west side of it. Two shafts on the south boundary of this lease show a coarsely crystalline epidiorite.

In G.M.L. 147, **Three Colonies Extended**, Inspector Angove reported that a shaft 63 feet deep had been sunk passing through a quartz reef two feet thick at 23 feet, and another of equal thickness at 52 feet, and that at 60 feet a great influx of water was met with. There was a battery of 10 stamps on Lease 88, and also a Langley Mill, the former was sold and removed, but portions of the latter remain. The Company deposed that they expended £43,000 on the property; Lease 88 became void in 1902. The Missfire became void in 1901, and was subsequently the **Primrose**, G.M.L. 845. The **Rescue**, G.M.L. 875 was also at this time applied for, adjoining the Desirable Extended. The Three Colonies became subsequently in part Q.C. 112 held by Mr. Hopper up to May, 1903, and also Q.C. 140 held by Messrs. Woods and party up to the month of April, 1904.

The following table gives the yield of the Three Colonies Reef, as deduced from official figures :—

Table showing the Yield of the Three Colonies Reef.

Year.	Name and No. of Lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ..	Three Colonies 88	...	240·00	...	...	169·85	
1898 ..	Do. ...	...	32·00	...	...	13·00	
1899 ..	Three Colonies 88, 89, 147, M.A. 10	...	62·00	...	...	32·75	
1900	Do. ...	...	16·00	...	...	22·27	
1901 ..	Do. ...	...		...	...		
1902 ..	Q.C. 112 ...	...	42·50	5·50	·95	70·61	State Battery.
		sweep'gs					
1903 ..	Do. ...	6·60	34·50	15·00	5·21	27·25	State Battery.
1903 ...	Unregd. Q.C. Woods	...	10·00	...	...	3·10	State Battery.
		6·60	**407·00**	**20·50**	**6·16**	338·83 6·16 6·60	
						351·59	or ·**864**ozs. per ton.

The Golden Bottle Reef.

The Golden Bottle, G.M.L. 112 of 12 acres on the north side of the last, is mostly on the lake bed and has a reef of several feet thickness trending south-east and north-west. An opencut has been made at the edge of the lake on a large reef which appears to be vertical and barren. The old workings are scattered about the lease and out on the lake bed, and are not well defined owing to the lapse of time and drifting sand. Inspector Angove's report indicates that seven shafts have been sunk vertically upon the lease, but none of these are shown on the map; No. 1 was carried down 34 feet; No. 2 was 22 feet with a drive to the south-east of 60 feet; No. 3 was 41 feet and met with a heavy influx of water; No. 4 had been carried down 22 feet with a drive to the eastward of 24 feet, in which heavy water is stated to have been struck; No. 5 shaft 38 feet with an eastern drive of 40 feet; No. 6, 24 feet in depth with a western drive of 6 feet, the shaft struck water at the bottom. There are no returns however from this reef.

The Criterion North Reef.

Nearly half a mile south-easterly of the last was the Criterion North, G.M.L. 216, of 12 acres, on a reef trending a little south of east and underlaying 75 degrees south, on which two shafts have been sunk and a prospecting shaft on an east and west reef, and a second prospecting shaft on another reef south of it, three or four chains; the size of the reefs was not ascertainable.

The Desirable North Reef.

On the north side of this lease was the Desirable North, G.M.L, 335, of 24 acres, a small north and south reef, the thickness of which could not be ascertained, underlays 60 degrees to east. Three shafts have been put down on it; another outcrop of a north and south reef of considerable size occurs in a gully about a quarter of a mile north. It has a dark coloured quartz, but appears to be barren.

The Moonta Norseman Reef.

The Moonta Norseman, G.M.L. 449 occupies a ridge of epidiorite rock half way towards the Princess Royal. There is a shaft about 100 feet on a short quartz reef trending north-east and south-west, the thickness could not be escertained [**5440**].

The Golden West Reef.

Nearly one mile east from here is the Golden West, G.M.L. 650 on kaolinised ground. At the north corner a shaft was sunk near the track, where there were some broken up portions of a quartz reef carrying 30dwts. values, but the large amount of water and the treacherous kaolin has prevented much prospecting being done. This ground may be worth more attention. The most suitable procedure would be by boring to locate the position of the reef that is probably hereabouts. This position is on the line of quartz dykes, and there may be a continuation of the line of reef from the Princess Royal in this direction. East of this was the IONA, G.M.L. 644 of 12 acres, which subsequently became IONA, G.M.L. 818, and was voided in December, 1900. This lease may have had a portion of the same reef that was met with in the Golden West.

Table showing the Yield of the Golden West Reef.

Year.	Name and No. of Lease.	Tons crushed.	Ozs. therefrom.	Remarks.
1898 ...	Golden West 650	50·00	52·27	State Battery
1898 ...	Iona 644	44·50	9·50	
		94·50	**61·77**	or ·654ozs. per ton.

The Mary Eileen Reef.

About one and a quarter miles north-easterly from here, at the edge of Lake Cowan, was the MARY EILEEN, G.M.L. 929, where a small reef was found, the application of which was withdrawn before survey.

Table showing the Yield of the Eileen Reef.

Year.	Name and No. of Lease.	Tons crushed.	Ozs. therefrom.	Remarks.
1904 ...	Mary Eileen 929	**16·50**	**8·11**	= 7·04 F or ·491 ozs. per ton.

The Princess Royal Sovereign Reef.

About a quarter of a mile south of the Iona was the PRINCESS ROYAL SOVEREIGN, G.M.L. 893 of 24 acres. Two shafts have been sunk here in kaolin to a depth of 60 feet in search of a continuation of the Princess Royal deep lead. A few chains south-east of these shafts there is a quartz reef outcrop trending south-easterly with an underlay of about 75 degrees to the south-west, on which a shaft has been sunk. This shaft is in the RIENZA, G.M.L. 834, of 15 acres, one of the Princess Royal North G.M. Co.'s blocks.

The Princess Royal Reef.

The PRINCESS ROYAL REEF, which the statistics show to have been one of the principal gold-producing reefs of Dundas, can be followed more or less uninterruptedly for a distance of at least 1,500 feet, though there seems to be good ground for believing it to extend much farther than this. The reef has been followed to a depth of 500 feet vertically below the level of the main shaft in the

Princess Royal lease, and to a depth of 950 feet in the new vertical shaft put down on the Princess Royal Central lease.

The reef has a general north and south strike with an average underlay to the east of 45 degrees; throughout its course it presents the usual variations in thickness which are characteristic of veins of the fissure type.

Parallel to what is called the main reef in the Princess Royal mine is the East reef, which outcrops at a distance of about 200 feet from it. This reef is not traceable to any great extent on the surface, nor does it appear to attain any thickness; it has been proved by mining operations and boring in this lease to a depth of 380 feet vertically below the surface.

On what is evidently the north end of this line of reefs is situated the **Princess Royal North** G.M., which has leases 634, 653, 687, 744, 745, and 634, containing 58 acres 2 roods and 22 perches; to this has to be added the Desirable leases 848, 870, and 915, or 26 acres more—total, 84 acres 2 roods and 24 perches. The shaft on the south boundary of G.M.L. 634 was sunk 70 feet on this reef, found here by costeening; another prospecting shaft was sunk about 150 feet north-easterly of this to a depth of 120 feet; each of these has 200 feet of drives. The main shaft is vertical, and has a depth of 390 feet [**5573**]. No. 1 level is at 250 feet; a cross-cut was put in west, reaching the reef at 114 feet; it was one foot thick here and of poor value; water was struck here. The drive north is 126 feet [**5576**], and to south 152 feet. The jointing of the amphibolite at this level is 55 degrees to the west, but the rock becomes foliated in the hanging-wall of the reef parallel to the latter, which underlays 20 degrees to east [**5574**]. No. 2 level is at 380 feet; the reef is here about 15 feet west of the shaft, and it has a felsite foot-wall; the drive north is 220 feet, and south 325 feet; a little stoping has been done on the former, and there is a winze where a quartz spur joins the reef and which here increases to two feet in width. The reef is very much split up into veins and is of poor value, except at the spur reef, where it was 2ozs. per ton. There is a battery here of 10 stamps. The total expenditure of the company up to March, 1904, is given as £21,285.

The **Princess Royal** G.M. since the end of 1898 has comprised the amalgamated leases 106, 187, and 587, embracing a total area of 51 acres 3 roods and 12 perches; and has been the principal gold-producing mine in the Dundas Goldfield (Fig. 13). Lease 106 was taken up by F. G. Chester and party on 2nd May, 1895. The original workings were on an outcrop of the main quartz reef in the middle of the lease. The general underlay of the reef is about 45 degrees easterly, and general trend north and south. The chute of ore which comprises most of the quartz to over 300 feet depth bifurcates to south-east from the above-mentioned outcrop; this is indicated on Plate I by the stoped portion. No. 7 shaft was used for some time as the working shaft until the main vertical shaft reached 515 feet, after which the two portions of the mine

FIG. 13.

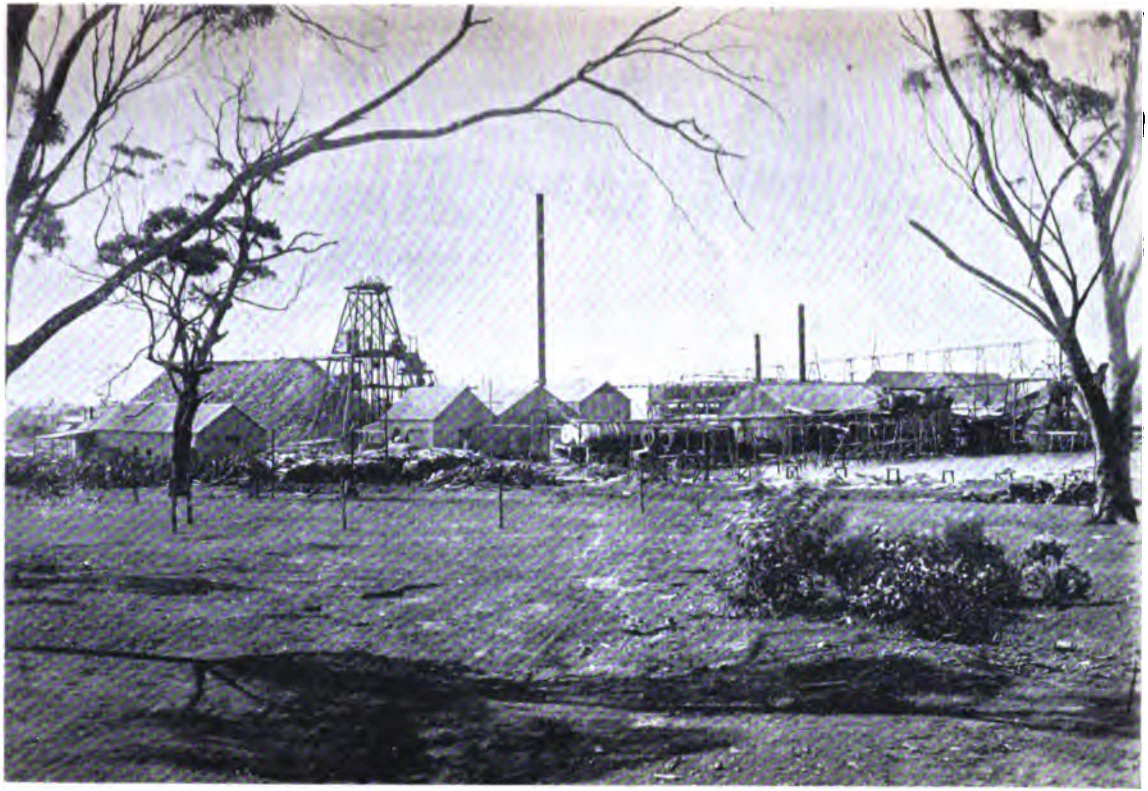


Photo., W. D. CAMPBELL.

Govt. Photo. Litho.

Princess Royal, G.M.L. 106, view looking north.

were connected by the levels driven through the intervening ground. The Eastern Reef is of small extent; its outcrop passes about 25 feet west of the main shaft, and has been worked down to the 200 feet level for a length of 120 feet. It is accompanied by a network of cross reefs. These workings are for the most part in a decomposed and kaolinised greenish felsite rock. There are several dykes of this felsite, all almost perpendicular, traversing the mine in a direction slightly east of north; it is less siliceous than the quartz porphyries, which constitute most of the other dykes in the district, but both varieties are locally called quartzite. This felsite decomposes readily into kaolin, which prevents any outcrop being seen. The dyke appears to have conduced to the deposition of the gold in the reefs where the latter traverse it. The north and central chutes have been stoped for a length of about 100 feet, the former down to the 380 feet level and the latter to the 200 feet level, where it merges into the principal body of quartz termed the south chute. Stoping has been done down to the 380 feet level on this line; in the middle portion of the chute some of the richest quartz has been found where the reef ranges up to 20 feet in thickness. A curiously shaped spur or lens of ore ranging up to 10 feet thick and 130 feet in length occurs between the 220 and 380 feet levels; its middle portion is flat and basin-shaped, and its foot is steep and dome-like. At the 380 feet level the quartz diminishes in quantity and quality, and the drive is being prosecuted southward towards a lens of ore found in the intermediate level above and beyond the main lens. The 500 feet level is clear of the felsite, and is much straighter than any previous one; it is on the lode channel the whole distance, which is not the case in some of the other levels in the barren ground; the quartz is met with in patches, excepting at the foot-wall fork of the reef, where it is strong; a dotted line on the plan shows the zigzag course of this fork at the different levels. A small amount of sulphide ore occurs below the 140 feet depth of the north chute, and below the 220 feet in the south chute. Boring with the diamond drill was commenced in June, 1904, to endeavour to test the locality of the reef in the next 200 feet below the 380 feet. Two bores were also made horizontally east and west. The positions of these bores are shown in Plate 1. The particulars as to the various formations pierced are as follow:—

No. 1 Bore from 380ft. level, at end (66ft.) of east crosscut; angle of depression, 70°.

43ft. to 45ft.—Quartz; assays trace of gold.

To 143ft. 6in.—Schistose amphibolite.

143ft. 6in.-153ft. 4in.—Quartz reef 4ft. thick; assay value, 10 grains; vertical depth about 516ft.

153ft. 4in.-153ft. 6in.—Hard hornblendic amphibolite.

163ft. 6in.-165ft. 6in.—Quartz; trace of gold.

165ft. 6in.-265ft. 7in.—End in very hard amphibolite. Total depth, 630ft.

No. 2 Bore from same locality; vertical.

To 70ft.—Schistose amphibolite.

70ft.-75ft. 6in.—Quartz reef 2ft. 6in. thick; assay value, 20 grains.

75ft. 6in.-85ft.—End in schistose rock. Total depth, 465ft.

No. 3 Bore from east crosscut, north of main shaft, 380ft. level. Due east; horizontal.

To 51ft.—Light green felsite; assay, 1-2dwts.

51ft.-62ft.—Schistose amphibolite.

62ft.-87ft.—Dark brown felsite.

87ft.-90ft.—Hard amphibolite; fine grained.

90ft.-124ft.—Softer amphibolite.

124ft.-201ft.—Amphibolite.

201ft.-240ft.—Schistose amphibolite.

240ft-241ft.—Quartz; assay value, trace.

241ft.-320ft.—Soft felsite.

320ft.-366ft.—Schistose amphibolite.

366ft.-367ft.—Quartz.

367ft.-391ft.—End in amphibolite.

No. 4 Bore west from No. 7 shaft.

To 48ft.—Amphibolite, with quartz veins highly mineralised.

48ft.-52ft.—Quartz mixed with amphibolite; no values; Jamaica reef (?)

52ft.-112ft.—Amphibolite.

112ft.-116ft.—Brownish rock; highly mineralised lode matter; value, 2dwts. 12grs.

116ft.-140ft.—Hard laminated amphibolite.

140ft.-269ft.—Hard amphibolite.

269ft.-270ft.—Quartz veins.

270ft.-446ft.—End in hard amphibolite.

Nos. 5, 6, 7, 8, and 9 bores are from the same locality, east crosscut, 500ft. level.

No. 5 Bore.—Angle of depression, 65°, bearing due east; total depth, 631ft.

To 95ft.—Schistose, with thin quartz veins.

95ft.-96ft.—Quartz veins; assay value, trace.

96ft.-120ft.—Schistose amphibolite.

120ft.-136ft.—Quartz porphyry.

136ft.-139ft.—Amphibolite.

144ft.—Softer amphibolite.

In progress.

No. 6 Bore.—Angle of depression, 45°, bearing 155°; length, 143ft.; total depth, 601ft.

96ft.-99ft.—Quartz; assaying trace.

143ft.—End in amphibolite.

No. 7 Bore.—Angle of depression, 41°, bearing 34°; length, 175ft.

123ft.—Quartz, and still in quartz at 142ft. Assay values of core: First 13ft., about 3dwts.; next 3ft., 1oz. 1dwt.; next 3ft., 10oz. The drill would at this point be 90ft. north of crosscut and at a vertical depth of 613ft. from surface.

No. 8 Bore.—Angle of depression, 50°, bearing 69°; length, 314ft.; total depth, 705ft.

No. 9 Bore.—Angle of depression, 39°; length, 315ft.; total depth, 700ft.

No. 10 Bore.—Horizontal from end of drive to south, 380ft. level; length, 226ft.; went off line of lode.

The country rock is fine and coarse-grained amphibolite; some of the former, in bore No. 3 [**6038**], was pyritous and very hard. It is massive with jointing to the west 75 degrees, but for about 10 feet adjacent to the reef it is frequently foliated in a direction parallel with the reef, as may be seen in the open-cut adjacent to No. 7 shaft and at the 380 feet level. This foliation does not occur, excepting to a very small extent, along the contact surfaces near the dyke, but is present where the quartz reef has been formed between the amphibolite and the dyke [**5456, 5457, 5459**]. The battery has 30 stamps, and there are 10 cyaniding vats, viz., five settling and five leaching vats of 100 tons capacity each, and three agitating vats of 20 tons, and also two filter presses. The workings of this mine are shown on Plate 1 accompanying this report.

The **Princess Royal Central** G.M. adjoins the eastern side of the Princess Royal mine and comprises leases 840, 874, 879, 894—being a total 86 acres.

As this Company held the ground of the same reef as the Princes Royal main reef at a depth on its underlay, there were two courses open to them to adopt; either to wait till the workings of their neighbours had shown where and how the reef was, or to exploit it. They chose the latter, and have gone about the proving of their ground in a very energetic and able manner.

The site of the main shaft, which is vertical, is 315 feet east of the 500 feet level of the Princess Royal, which has been driven since this shaft was begun on the 17th February, 1904. Rock drills were employed after 11th June, 1904, and a depth of 841 feet was reached on 17th February, 1905, a year's work, establishing a record for rapidity of sinking in the district. After the first 35 feet of decomposed rock, the hard amphibolite was met with and continued to 340 feet, when a slight change occurred and a formation at 415 feet. At 573 feet a pyritous vein was cut nine inches thick, which assayed traces of gold [6117]. Water was met with here which caused sores to appear upon the miners employed in sinking below this, in all probability due to the presence of sulphuric acid derived from the decomposition of the pyrites. Another formation occurred at 760 feet with quartz veins assaying, the manager informed me, 15 to 22 grains of gold. On 1st March, 1905, at 870 feet some veins of quartz [6118] were met with underlaying 55 degrees to the east and a short distance below this a felsitic dyke three to four feet thick, with a westerly inclination. The country rock here is similar to that on the hanging-wall of the 500 feet level of the Princess Royal, and continues down to a seven feet quartz reef at 934 feet which, however, did not here show any gold. The shaft was continued to 950 feet, and drives were being started north and south. The north drive shows a reef five feet wide, three feet of which is poor grade and the rest high grade stone. In the south drive the reef is much broken up. The country rock throughout is finely and coarsely crystalline amphibolite.

Princess Royal South G.M. Co. have four leases, 647, 678, 698, and 841, embracing in all an area of 41 acres, that adjoin the south boundary of the Princess Royal G.M., and are evidently on the same line of reefs. The old shaft near the west side of G.M.L. 647 was not accessible at the time of my visit. According to Mr. Catlin's account, it was sunk 76 feet vertically, when some small quartz veins were met with, which underlaid to the east, and they were tried by short crosscuts and a drive, but were all found to be barren. The shaft was continued to 152 feet on the underlay. At 122 feet a 12 inch quartz vein was met with containing a little gold, it however narrowed to a leader and was cut by a felsite dyke from the foot-wall. At 130 feet mineral specimen [736] was obtained; it is very much the same kind of material that forms the dykes of the Princess Royal. This felsite continued for 20 feet, when some rubbly quartz was met with four to five feet thick, with a solid centre, which yielded a little gold. No further work was done here, but the main shaft was sunk vertically to the eastward to intersect this reef, which was met with at 210 feet. The total depth attained by the shaft was 250 feet, at which depth a crosscut was put in westerly 204 feet, and another easterly, which reached the reef at 50 feet where it proved to be very flat (about 10 degrees to east); the reef continued in the crosscut to 74 feet, when drives were put in north 68 feet and south 81 feet respectively. The quartz is somewhat opaque or stony with a green tint, possibly due to an intermixture of felsite with it [5474], and no values were found. The general underlay of the reef is about 45 degrees; work was in progress here at the time of my visit. The adjacent rock is a coarse-grained amphibolite slightly foliated near the reef [5472, 5473]. At the bottom of the shaft there is a small quartz vein nearly vertical, striking 30 degrees west of north. A close, fine-grained diorite [5471] appears here in the form of a laccolite or horizontal sheet; it was evidently intruded into the coarser grained amphibolite [5472]. dyke rises slightly to the west and at 50 feet in the crosscut, and forms the whole of the rock in the crosscut to about 150 feet, where a few stringers of quartz occur; work was stopped here on account of the excessive hardness of the rock. A small shaft at the south-west corner of this area is sunk on a similar kind of quartz as is to be seen on the dump of the other old shaft. There have been apparently no crushings by this mine. The expenditure of this company up to June, 1904, was £10,075.

The following figures give, in a tabular form, the yield of the Princess Royal Reef, in so far as such may be deduced from official data:—

Table showing the Yield of the Princess Royal Reef.

Year.	Name and No. of Lease.	Tons crushed.	Cyaniding.		Gold from crushing.	Total.	Remarks.
			Tailings.	Gold.			
			tons.	ozs.	ozs.		
1900	Princess Royal North 634 and 653	20	...	...	32·80	...	
1901	Princess Royal North 634	92·50	...	...	43.76	...	36·06 F
		112·50	...	...	...	76·56	
1897	Princess Royal South 187	358	...	...	640	640	
1896	Princess Royal 106 ...	10	...	...	120	120	
1897	Princess Royal 106, 587	2,074	1,406	837·35	4,151·68	4,989·03	P.R. Coy.
1898	Princess Royal 106, 587, 650	6,136	3,192	1,404·87	9,091·30	10,496·17	,,
1899	Princess Royal 106, 187, 587	11,804·50	3,792	2,409·28	9,327·64	11,736·92	,,
1900	Princess Royal 106, 187, 587	13,071	18,648	7,722·14	10,741·95	18,464·09	
1901	Princess Royal 106, 187, 587	18,233	14,835	4,397·25	13,020·85	17,418·10	
1902	Princess Royal 106, 187, 587	18,073	13,888	2,841·50	17·700·45	29,541·95	
1903	Princess Royal 106, 187, 587	20,357	16,156 8,969 117	2,748·95 3,944·05 842·05	21,365·70	28,900·75	
1904	Princess Royal 106, 187, 587	22,261	17,200 12,563 115	2,380·25 4,328·10 550·70	14,406·25	21,665·30	17,531·16 F. 2,690·75 Silver
		112,602·50	110,881	34,406·49	100,642·38	135,048·87 or 1·1993 ozs. per ton	

The Hidden Treasure Reef.

This fairly well-defined reef lies about 1,300 feet north of the large norite dyke which traverses the field in an east and west direction. The reef outcrops on the southern slope of a conspicuous rise to the south-west of the Princess Royal townsite. So far as may be seen on the surface, the reef can be followed for a distance of about 500 feet. Here the **Hidden Treasure**, G.M.L. 211, of 18 acres, was situated, it was abandoned on the 5th April, 1897, and became subsequently, in part, **Prince of the West**, G.M.L. 648, of 12 acres. The reef has an east and west course underlying south;

the main shaft is stated to be 150 feet, with a 40-feet drive, another shaft 25 feet deep, with 80 feet drives and winze 15 feet, and another shaft 47 feet deep; some stoping has been done adjacent to the main shaft. The reef is of small size, but has a good appearance. The country rock is fine-grained amphibolite. The lease was void in October, 1898, and in 1900 became in part Q.C. 59, held by Mr. Denis Duggan; this was forfeited during 1903, and eventually became Q.C. 124, held by Messrs. Stockton and Diack since May, 1903.

The table gives the yield of the Hidden Treasure Reef:—

Table showing the Yield of the Hidden Treasure Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ..	Hidden Treasure, 211	...	82·00	...	...	63·30	Bevilaqua
1897 ...	Prince of the West, 648	...	33·00	...	...	25·06	
1898 ...	Do. ...	...	63·50	...	...	57·49	
1899 ...	Q.C., 59	...	15·00	...	...	9·30	Bevilaqua
1900 ...	Do.	...	4·00	...	...	2·15	Do.
1903 ..	Q.C., 124	...	20·50	15·00	3·66	15·98	State Battery
			218·00	15·00	3·66	173·28 3·66	
						176·94	or ·811ozs. per ton

About a quarter of a mile south of this is the norite ridge, which averages three-quarters of a mile wide, in which there are no reefs.

The Federation Reefs.

This small group of reefs, within the boundaries of the 12-acre lease, seem to have returned a fair quantity of gold. The main or north and south reef, upon which most of the work has been done, has only a very short outcrop, and a dip to the east at an average angle of about 20 degrees. The position is about three-quarters of a mile south of the norite and half-a-mile east of the Coolgardie road. The first lease here was the Tommy Atkins, 746, of 12 acres, on the top of the low hill. There are here several small reefs in various directions besides the north and south reef. All have very uncertain courses. The old main shaft is 53 feet on the underlay, with 40 to 50 feet drives, with a winze down another 56 feet. The reef is 12 to 15 inches thick. The lease was forfeited in April, 1900, and subsequently became the Federation, G.M.L. 802, of 12 acres. A vertical shaft was sunk 50 feet to cut the reef deeper, but failed to meet with it, and a drive was being put in towards it at the time of my visit. On the northern cross reef there is a shaft 30 feet vertical and 25 feet on the underlay. There are also several prospecting shafts on cross reefs adjacent to the lease.

The following table gives the yield of the Federation Reefs, the average return from which seems to have been high :—

Table showing the Yield of the Federation Reefs.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushing.	Remarks.
1899 ..	Tommy Atkins, 746	...	28·00	...	...	7·25	
1900	Federation, 802 ...	...	57·50	...	...	137·62	
1901	Do. ...	...	93·00	..	...	122·45	
1901 ..	Do. ...	...	..	18·00	4·66	...	State Battery
1902 .	Do. ..	..	57·00	...	...	128·91	
1902	Do. ...	...	...	25·50	15·63	..	State Battery
1903	Do. ..	...	34·50	...	...	69·78	
1903 .	Do. ...	...	...	41·50	20·67	..	State Battery
1904 .	Do. ..	...	...	14·00	·11	...	
			270·00	99·00	41·07	466·05 41·07	
						507·12	or 1·878ozs. per ton

The Venture Reef.

The Venture Reef, so far as may be inferred from an inspection of the surface, has a very sinuous and interrupted outcrop of about 1,200 feet length, with a very varying underlay to the south. This vein, which has a varying thickness from 12 to 18 inches, has been followed to a depth of about 40 feet vertically below the surface, and has proved a good gold producer. It is situated about 30 chains easterly from the Federation; the ground was taken up first as the Thule, G.M.L. 193, of 18 acres, which included two reefs. The southern one has a north-westerly course and underlay to east; two shafts have been sunk upon it. The northern one runs east and south-east sinuously, with a varying underlay up to 55 degrees. There is no record of any crushing from this lease, which became void in December of 1897. The Aveline, Q.C. 128, held by Thomas and party, was subsequently here on the east and west reef, as well as the Venture, G.M.L. 887 of six acres, when an underlay shaft was put down 40 feet, and driving and stoping done, with very good results.

The table, the data forming which have been obtained from official sources, gives the yield of this reef :—

Table showing the Yield from the Venture Reef.

Date.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1901 .	Venture 887 ...	...	12·00	...	...	12·60	State Battery
1902 .	Do. ...	...	..	8·00	1·25	...	Do.
1903	Do. ...	...	70·00	...	..	66·50	
1903 .	Do. ...	...	...	58·00	8·05	...	State Battery
1904	Do. ...	8·44	...	...	...	...	= 6·95 F.
1904	Do. ...	...	318·50	...	...	322·63	= 256·09 F.
1904	Do. ...	...	...	192·00	36·95	...	State Battery
1903	Q.C. ·128, Aveline	...	81·50	43·00	14·20	110·57	Do.
1904	Do. ...	...	26·50	36·00	8·78	33·44	= 27·56 F.
		8·44	508·50	337·00	69·23	545·74 69·23 8·44	
						623·41	or 1·226ozs. per ton

The Lucky Hit Reef.

The **Lucky Hit Reef** is another short east and west reef underlying southward, which has been opened by several shafts. The ground was taken up at the south end of the Thule as the **Lucky Hit**, G.M.L. 108, of 12 acres. This included two reefs, the Lucky Hit Reef and the northern extension of the Maloney Reef. The latter was met with at the old main shaft, at the south-west corner, 120 feet; it struck the Maloney Reef at that depth, where it was three feet thick, according to Mr. Angove. Three other shafts are each 50 feet in depth, and while no information is available of the workings, the yield of the Lucky Hit Reef may include a return from Maloney Reef, it being impossible to separate the two, as both occur within the boundaries of the same lease, as the stone may not have been separately milled. The northern reef has had two shafts sunk on it, one of them 70 feet deep, together with drives and stoping. The lease became forfeited at the close of 1897, and subsequently in part the **Kyneton**, G.M.L. 712, of 12 acres. This latter was forfeited in 1899. The northern portion of these two last leases became subsequently in part the **King William**, G.M.L. 871, of 4 acres 3 roods and 34 perches, which became void in 1904, whilst the remainder was held as **Prospecting Area** 54. The yield of the Lucky Hit Reef is given in the attached table:—

Table showing the Yield of the Lucky Hit Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Lucky Hit 108 ...	...	43·00	...	...	13·50	Bevilaqua
1898 ...	Do. ...	...	63·00	...	...	26·40	
1898 ...	Kyneton 712 ...	...	12·00	...	...	5·40	
1899 ...	Do. ...	...	54·00	...	..	18·25	
1900 ...	Q. Claim ...	..	15·00	...	...	5·00	Bevilaqua
1903 ...	King William 871	.	30·00	...	...	49·10	State Battery
1903 ...	Do. ...	...	...	21·33	5·57		
1904 ...	Prospecting Area 54 ...	...	43·00	...	...	25·30	= 17·86 F. State Battery
1904 ...	Do. ...	...	...	13·00	1·91	..	
			260·00	34·33	7·48	142·95 7·48	
						150·43	or ·578 ozs. per ton

The Maloney Reefs.

About ten chains south of the Lucky Hit lease 108, the principal Maloney reefs, three in number, outcrop strongly and trend about 23 degrees, with an underlay of about 40 degrees to the east, there are also said to be several cross reefs. These reefs vary from one foot to six feet, and have yielded about ½oz. per ton.

The MALONEY, G.M.L. 56, of 12 acres, adjoined the south end of 108. Mr. Angove's report of 1896 mentions that No. 1 and No. 2 shafts on underlay were 60 feet and 35 feet on a reef four feet wide. No. 3 shaft on a parallel reef five feet to six feet wide was 135 feet vertical and 15 feet on the underlay. It is said that "made ground" was met with in a drive at the 135 feet level, but it seems hardly probable, there may have been some disturbance there due to the quartz porphyry dyke which outcrops about two chains from the shaft. The quartz has a good appearance and the country rock seems much decomposed, judging from the dump (see returns.) The ground was forfeited in September, 1897, and became subsequently the THREE KINGDOMS, G.M.L. 655, of 12 acres, which was withdrawn towards the close of 1899. The northern portion became the TWO WILLIAMS, G.M.L. 881, of five acres, and existed as such from May, 1903, to February, 1904, when it and a portion of the GLADSTONE, G.M.L. 256, was taken up as P.A. 57. The southern portion of 655 then became the NEVER DESPAIR, G.M.L. 798, of five acres, and was forfeited in May, 1901. It was subsequently applied for in June of that year as the COME AGAIN, G.M.L. 830. The Come Again existed until August, 1902, when it became void, and was applied for by W. Campbell in 1902 as Q.C. 108. This latter being resumed in January of 1904; part was also held by W. J. Southwell from May, 1903, as Q.C. 125, but was surrendered in the month of September and subsequently held by Haines and Trotter as Q.C. 127, from which there were no returns. This Q.C. 127 was surrendered in October, 1903. Part of the Come Again was, in June, 1903, applied for by Richards and Stephen as Q.C. 132, and abandoned in January, 1904, but was again applied for by Tooth and Gee as Q.C. 142, and subsequently held by Richards and party as an UNREGISTERED Q.C. Part of the Come Again was also occupied in 1903 by Greer and Party as an UNREGISTERED Q.C. I was informed by Mr. Greer that he had two other crushings, besides the one given below, of 10 tons, each yielding about 10 and 3ozs. respectively, but I have not been able to trace them.

At the south end of the Maloney was the LADY ELLEN, G.M.L. 63, of 12 acres, where several shafts were put down to a depth of 50 and 60 feet, to find the southern continuation of the Maloney reefs; but these may follow perhaps the direction of the sweep of the Quartz porphyry dyke. In regard to the Gladstone, G.M.L. 256, of 6 acres, on the east of the Maloney, Mr. Angove mentions two shafts, both vertical, 80 feet and 40 feet, void 17th December, 1897, subsequently part of P.A. 57. In these and GLADSTONE NORTH G.M.L. 462, GLADSTONE EXTENDED, G.M.L. 292, and MALONEY SOUTH, G.M.L. 383, on the eastern side of the Maloney line of reefs, there is apparently nothing of interest to record beyond the quartz porphyry dyke, which sweeps round from the Never Despair to the

King William, and another in the Gladstone Extended. The returns from the Maloney Reefs have been shown in the table below :—

Table showing the yield of Maloney Reefs.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushing.	Remarks.
1896 ...	Maloney 56 ...	...	50·00	...	...	58·00	
1897 ...	Do. ...	...	122·00	...	...	50·15	Bevilaqua
1897 ...	Three Kingdoms 665	...	62·75	...	...	11·15	
1898 ...	Do. ..	...	30·50	...	...	13·15	
1899 ...	Do. ...	..	10·00	...	...	2·55	State Battery
1900 ...	Never Despair 798	...	112·00	...	...	29·65	
1901 ...	Do. ...	...	16·00	...	...	35·05	State Battery
1901 ...	Come Again 830	...	20·00	13·00	3·05	28·45	
1902 ...	Q.C. 108	...	24·00	53·00	15·01	37·05	
1903 ...	Q.C. 125	...	90·50	...	...	31·35	
1903 ...	Q.C. 132	...	55·50	8·00	7·20	29·86	State Battery
1903 ...	Q.C. 142	...	22·00	...	...	9·30	Do.
1903 ...	Q.C. 172	...	28·00	...	...	16·24	Do.
1903 ...	Unregistered Q.C.	...	54·50	...	...	25·38	Do.
1903 ...	Unregistered Q.C.	...	16·00	...	...	5·20	Do.
1903 ...	Two Williams 881	...	33·00	...	...	16·35	
1904 ...	P.A. 57	...	17·50	...	...	6·80	= 5·60 F.
			764·25	74·00	25·26	405·68 25·26	
						430·94 or	·563 ozs. per ton

The Lady Clara Reef.

About three-quarters of a mile south of the Maloney was the Lady Clara, G.M.L. 66, on the north and south line of quartz porphyry on the east side of the hill where the new Government battery is. The dyke is accompanied by a few quartz veins, and at the northern end it is schistose, apparently from pressure. The lease became void in July, 1895, and was subsequently Lady Clara G.M.L. 144, 12 acres. There is one shaft 30 feet deep on the dyke at the crossing of Bevilaqua's abandoned tramway line. This lease was forfeited 3rd August, 1896.

At the south end was the Rising Sun No. 1, G.M.L. 304, of 6 acres, void 19th August, 1896. These became in part Castlemaine, G.M.L. 578, of 24 acres, but became void in October, 1898.

The Thames Reef.

At the north-east foot of the same hill, and crossing the old Buldania track, there is a quartz reef underlaying west, on which Thames, G.M.L. 411, Thames No. 2, G.M.L. 430, and Euclid, G.M.L. 429 are situated, each 12 acres.. The reef is near a quartz porphyry dyke. G.M.L. 430 has two shafts which, according to Mr. Angove's report of 1896, are 85 feet on a two-feet reef, and (vertical shaft) 52 feet, with a cross-cut west at bottom. The Euclid, G.M.L. 429, has a shaft 65 feet deep on westerly underlay, and one 10 feet, according to Mr. Angove. There are no crushings recorded from this group.

The Mararoa Reef.

The next line of reef to the eastward is the *Mararoa Reef*, which extends in a north and south direction along the northern portion of the foot of the west front of the Norseman Hill for a distance of three-quarters of a mile; it underlays about 45 degrees to the east; the average thickness is probably four feet, as it ranges up to eight feet in places, and has yielded over one ounce to the ton.

On the northern prolongation of the line of this reef is the **Cosmopolitan**, G.M.L. 321, of 18 acres, with one 25 feet vertical shaft and one 35 feet on the underlay. To the south of the last was the **All Nations Extended**, G.M.L. 97, of 12 acres. On the west side of this was the **British Norseman**, G.M.L. 442, of 18 acres, in which Mr. Angove states a shaft was sunk on a cross reef, vertically 15 feet and on the underlay 40 feet southerly; also the **West All Nations**, G.M.L. 613, of six acres. South of No. 97 was the **All Nations**, G.M.L. 39, of about 12 acres. Leases 321, 97, 613, and 39 all belonged to the All Nations G.M. Co., by whom it was, in May, 1898, surrendered on consideration of the purchase by the Government of their machinery on lease 97, for the first State battery. From Mr. Angove's account, the main shaft seems to have been 154 feet vertical in part, at least. There are two shafts on the underlay of 40 degrees to east, 90 feet and 46 feet; on the west side were **McCarthy's**, G.M.L. 175, **and Homeward Bound**, G.M.L. 286, both of 12 acres, in which there are only some small east and west reefs. There is a shaft in each lease, Mr. Angove gives 30 feet as depth of the shaft in McCarthy's and 12 feet in the Homeward Bound; both leases were void in December, 1897.

At the south end of the All Nations is the **Bethnal Green**, G.M.L. 67, of 12 acres, in which there is a strong body of quartz. The old main shaft is 35 feet vertical and 35 feet on underlay, there are two other shafts 40 feet each and another 65 feet. The Bethnall Green lease became void in October, 1898. It has recently been applied for afresh as **Bethnal Green**, G.M.L. 939.

The steep spur of the hill at the south end is hard, fine grained amphibolite rock. At the south end of Bethnal Green were the **Mararoa Extended** N., G.M.L. 298, and **Excelsior**, G.M.L. 68, these were amalgamated leases, owned by the Excelsior G.M. Syndicate; the reef is four feet wide, and the dumps show it to be accompanied by a schistose amphibolite. There are three shafts on G.M.L. 68, but particulars regarding these are not available; 20 tons only seem to have been crushed, however, and the leases were forfeited about the middle of 1897, as was also No. 1 N. **Norseman**, G.M.L. 273, adjoining, on the top of the spur.

The **Mararoa**, G.M.L. 60, was taken up by Goodall and Firth in December, 1894, it passed into the hands of R. Grimes, who sunk three shafts 150, 110, and 80 feet deep respectively; and in May, 1897, it was estimated that there were 800 tons of stone raised, but the lease was forfeited in 1898 without any record of crushing returns being available, the lease became in part **Mararoa**, G.M.L. 704, of 24 acres, and yielded 3,135 ounces of gold. The lease was surrendered in 1902 and became **Mararoa**, G.M.L. 852, and has been worked continuously since. The holders, Messrs. Pascoe, Crabb, & Co. also have G.M.Ls. 759 and 912, all of 12 acres each, and own Bevilaqua's battery; the latter had been known from 1899 to 1902 as the Norseman Crushing and Cyanide Works. There are three underlay shafts, the south shaft 145 feet on underlay of about 45 degrees was at first the main shaft, the middle shaft of 100 feet and 40 degrees. The reef is here of two parts, close together at surface and four feet apart below. The first workings were on the western portion. The eastern reef has since proved the best, and is six feet to 10 feet wide, portions showing gold. A remarkable folding of the reef occurs here (or it may be a junction with a large cross reef); these two shafts are connected by a drive on the reef at 150 feet level, the whole of the reef is being crushed at their battery.

The **Victoria Norseman**, G.M.L. 90, on the eastern side, became void in June, 1896, and was subsequently in part **Victoria Norseman**, G.M.L. 500, which was forfeited in January, 1897, and is now in part **Mararoa East** G.M.L. 912. There appear to be no crushings as yet from this ground.

The **Mararoa South**, G.M.L. 126, of 12 acres, is on the southerly continuation of the same reef, and has several underlay shafts. Mr. Angove states that the main shaft is sunk 110 feet on underlay. From the 70-feet level a drive goes south 70 feet and north 30 feet, also a crosscut from same depth 35 feet west and 35 feet east. The quartz appears to be very white and of poor value, and there are no records of any crushings. The lease became void in December, 1897, and became subsequently the **Mararoa Extended**, G.M.L. 759, voided August, 1896; subsequently in part Esperanza G.M.L. 941, not surveyed; still in force. South of this again was the **Marora Junction**, G.M.L. 283, of eight acres three roods 22 perches, in which a shaft of 50 feet was sunk; the lease became void on 17th December, 1897.

Table showing the Yield of the Mararoa Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1896 ...	Excelsior 68 ...	...	20·12	..	...	11·00	Bevilaqua
1897 ...	All Nations 39 and 97	...	200·00	..	...	67·60	
1900 ...	Unreg. Q.C. ...	...	72·00	64·00	6·08	17·60	State Battery
1901 ...	Do. ...	...	26·00	19·00	3·44	15·29	Do.
1902 ...	Do. .	...	37·00	...	...	18·20	Do.
1903 ..	Do. ...	...	92·00	73·30	11·51	12·48	Do.
1904 ...	Do. ...	...	33·00	...	..	11·91	= 7·71 F. Do.
1904 ...	Q.C. 168, Bethnal Green	...	17·50	...	...	4·05	= 3·33 F. Do.
1898 ...	Mararoa 704 ...	...	279·50	...	...	179·75	
1899 ...	Do. ...	...	1,024·00	...	...	736·90	
1900 ...	Do. ...	...	820 00	36·00	6·97	439·90	
1901 ...	Do. ...	...	...	sands ... slimes...	1216·07 56·00		
1902 ...	Do. ...	...	...	1,908·00	500·10		
1903 ...	Do. 852 ...	...	430·00	1,820·00	423·95	131·97	
1904 ...	Do. ...	...	1,530·00	...	...	764·45	=444·59 F. Do.
1904 ...	Do. ...	...	...	1,800·00	807·85	...	= 401·86 Do.
		...	4,581·12	5,720·30	3,031·97	2,411·10 3,031·97	=846·43 F. Do.
						5,443·02	or 1·188ozs. per ton

Besides the tailings at the Mararoa battery from stone from their own lease, the Syndicate had many years' accumulated tailings from parcels of stone crushed for the public; these were commenced to be treated in 1902.

Table of result of Cyaniding of Sands at the Mararoa Battery.

Year.	Locality.	Tons.	Ozs.	Remarks.
1902 ...	Various parts of the field ...	1,900	500·00	
1903 ...	Do. do. ...	2,210	526·95	
1904 ...	Do. do. ...	900	189·60	= 133·98 F. and 38·75 Silver.
	Total	5,010	1,216,·65	

Lily and St. Patrick Reefs.

About one-third of a mile east of the Venture and Maloney reefs are a group of leases on the flat, where there is a network of reefs. The northern-most of these leases is the Zimmerman, G.M.L. 412; this and the Yatala, G.M.L. 586 were upon a north and south schistose lode formation about six feet wide; in the latter were several underlay shafts, the western-most being at least 45 feet deep. Inspector Angove's report 1896 states that the lode was six feet wide. On the east side was the Golden Dyke, G.M.L. 377, which Mr. Angove states in 1896 had four shafts, two being on a north and south reef, three feet wide, underlaying east, one shaft being 12 feet vertical and 48 feet on underlay, and two lesser shafts on an east and west reef. According to Mr. Angove none of these leases have had any returns.

The Golden Allie, G.M.L. 376 (also known as the Lucindale) was to eastward of the last, and had an underlay shaft 35 feet on a lode 15 inches wide, and a 20 feet vertical shaft, according to Mr. Angove.

To the south of the last, was the Miss Harriet, G.M.L. 332, which, having been forfeited in 1898, became subsequently in part the Livingstone, G.M.L. 694.

To the south of these was the Lily, known also as the Golden Bar, G.M.L. 380, which had a north and south reef on its western boundary, underlaying east and about two feet six inches thick; this was thought by miners to be a reappearance of the All Nations reef. The lease was forfeited early in 1898; and subsequently became the Lily, G.M.L. 695. Two shafts were sunk upon the property; the south one is about 70 feet, and the north about 80 feet vertical and 40 feet on the underlay, stoping was done from a drive at the bottom where the reef thinned out greatly. The Lily became void in 1901, and was subsequently in part Q.C. 123, Two Hills, held by J. Garrett for a period of six months ending October, 1903, and a small crushing obtained. Part of this ground became a twelve-acre lease, the **Iris**, G.M.L. 908, details of which may be found in the table appended, and is in force. Portions of the Miss Harriet, Livingstone and Lily 695 became the **St. Patrick**, G.M.L. 702 which was voided in 1900; and subsequently the **St. Patrick**, G.M.L. 849, at the end of the year 1901, since which date a well defined east and west reef has been worked, underlaying about 23 degrees to south. There are two principal shafts, one about 240 feet on the underlay, and another vertical 135 feet, which cuts the reef at 120 feet. The width of the reef varies from three inches to four feet. Water occurs at 135 feet; slickensided surfaces are prevalent in different parts of the reef; there is a clay hanging wall and an ironstone vein on the footwall. The gold makes where the ironstone touches the quartz. The quartz is mostly of cloudy blue tints with a banded appearance [5929]. Mineral fat is plentiful. A good deal of stoping has been done up to 200 feet east of underlay shaft; the best stone only is taken out instead of being worked systematically.

Table showing the Yield of the Lily Reef.

Year.	Name and No. of lease.	Ozs. Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1896 ...	Golden Allie 376 ...	...	6·25	...	...	2·15	
1897 ...	Lily 695	...	26·00	...	...	8·00	Bevilaqua.
1898 ...	Do. ...	...	278·00	...	...	123·50	
1899 ..	Do. ..	...	118·00	...	...	99·38	
1900 ..	Do. ...	...	59·00	...	...	55·50	
1901 ..	Do. .	...	87·00	14·00	2·28	45·53	
1903 ...	Q.C 123	...	41·00	...	...	37·17	
1904 ...	Do. ...	...	20·50	16·33	2·10	6·70	
		...	635·75	30·33	4·38	320·16 4·38	
						324·54	or ·510ozs. per ton.

Table showing the Yield of the St. Patrick Reef.

Year.	Name and No. of lease.	Ozs. Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1898 ...	St. Patrick 702 ...	...	135·90	...	...	68·48	State Battery
1899 ...	Do. ...	...	55·00	...	...	15·36	
1900 ...	Do. ...	...	..	...	...	...	
1901 ...	Do. 849 ...	..	65·00	50·00	9·66	94·23	
1902 ...	Do. ...	124·61	224·00	...	...	467·92	
				178·00	47·00	...	State Battery
1903 ...	Do. ...	26·20	129·50	...	...	236·80	
				84·25	19·18	...	
1904 ...	Do. ...	...	98·00	...	...	397·90	346·22 F. Do.
1904 ...	Do. ...	32·70	...	...	...	...	28·67 F. Do.
1904 ...	Do. ...	..	...	66·50	34·41	...	Do.
		183·51	707·40	378·75	110·85	1280·69 110·85 183·51	
						1575·05	or 2·226ozs. per ton.

The Record Reef.

The **Record Reef** is at the south end of a hill one mile south-easterly from Trig. Hill B 23. It is curved in between some quartz porphyry dykes in a north and south direction, and has an easterly underlay of about 65 degrees.

The **Record**, G.M.L. 498, was here, and had a shaft 60 feet, and Mr. Catlin states that a drive was put in at 50 feet, and some stoping done on the reef, which strikes north and south, varies in thickness up to 18 inches, and underlays at 65 degrees to east. There seems to be no record of any crushings; the lease was forfeited 1897. The ground was reapplied for in December, 1898, as **Block 14 Proprietary**, G.M.L. 729, when the shaft was deepened to 100 feet, and drives put in at the bottom, and more stoping done on a portion of the reef bunched up against a quartz porphyry dyke. Q.C. 22 was applied for here by W. R. Gee, in January, 1899, but after holding it for about three months the ground was abandoned. The ground eventually was taken up again as the **Record**, G.M.L. 901. A new shaft was sunk about a chain east of the previous shaft, and a quartz leader two to six inches thick, showing gold freely, was met with, but this thinned out in a drive which followed the reef northward into the above-mentioned quartz porphyry. On panning off the dollied quartz, a brown coloured residue remained with the quartz; this was determined in the Departmental Laboratory to be scheelite [5960], a compound of tungstic acid and lime, which is of some commercial value, if obtainable in sufficient quantity. The reef is said to be traceable at intervals to 15 chains to the northward to the site of Q.C. 7, **New Find**, held by C. W. Perignon and H. Hawkins. A shaft was sunk here to about 80 feet on the underlay. Another Q.C., **Jokaser**, is said to have been held on the same reef.

Southward of the Record is **Quartz Area** 19, where a shaft was sunk on a leader occurring in the westernmost quartz porphyry dyke.

Table showing yield of the Record Reef.

Year.	Name and No. of Lease.	Dollied ozs.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1898 ...	Block 14 Proprietary 729	...	17·00	...	...	31·52	
1899 ...	Do. ...	4·42	71·50	...	...	78·76	
1900 ...	Do. ...	...	...	...	...	—	
1901 ...	Do. ...	...	6·00	...	...	1·15	State Battery
1899 ...	Unregistered Q.C. New Find	...	18·00	...	...	7·95	Bevilaqua and State Battery
1901 ...	Do. ...	...	...	13·50	3·60	...	State Battery
1904 ..	Record 901 ...	...	8·50	5·00	·86	8·55	= 7·04 F.
		4·42	121·00	18·50	4·46	127·93 4·46 4·42	
						136·81 or 1·131 ozs. per ton	

Never Mind Reef.

About a quarter of a mile north-easterly on the top of the ridge and about 250 feet from the large quartz porphyry dyke is apparently the site of the **Never Mind**, G.M.L. 120. A shaft was put down and an open-cut made on a reef bearing 345 degrees with an underlay east of 40 degrees, but no particulars are available; the application was withdrawn before survey. There do not appear to have been any crushings recorded from this locality.

The Northern Star Reef.

Half a mile to the south-west of the Record is the northernmost end of the Northern Star reef which extends southerly in a sinuous line for a distance of 5,000 feet, it is on the line of prolongation of the Norseman reef, but there is a blank interval between of 5,000 feet, the characters of the two adjacent ends of these reefs are identical. The underlay is from 43 degrees to 60 degrees to east and has been proved to a vertical depth of 140 feet.

The northernmost lease was the **Last Chance**, G.M.L. 344, on the line of the valley which crosses here. A shaft 40 feet deep is mentioned by Mr. Angove in his report of 1896; the lease was forfeited in August, 1896. Next was the **Jessie Margaret**, G.M.L. 177, of 18 acres, in which there is a long line of reef outcropping, with four shafts underlaying east; Mr. Angove mentions two shafts in 1896, 40 feet each; the property was forfeited in July, 1896. Next is the **Gipsy Girl**, G.M.L. 131, with outcrops of the same reef with two shafts with an average underlay of 60 degrees. The amphibolite to be seen in the dumps is foliated. There is also a cross reef on which there is a small shaft.

Next is the **Bohemian**, G.M.L. 124, with three shafts; the reef is three feet wide, and Mr. Angove states that in 1896 there was a vertical shaft of 70 feet, with 50 tons of stone at grass. There is a quartz porphyry outcrop on the east side of the reef; this dyke appears to be along the same line along which the quartz reef was subsequently formed; both have probably contributed to the foliation of the adjacent amphibolite. Next is the **Sudden Norseman**, G.M.L. 44, on which a good deal of work was done by the Sudden Norseman and Macedonian G.M. Co., this lease being amalgamated with the **Macedonia**, G.M.L. 139, which adjoins it on the east. The workings were inaccessible at the time of my visit. There are five shafts, two vertical 86 feet and 92 feet, connected by a drive at bottom, a third vertical shaft 6 feet by 3 feet to 125 feet, and two underlay, which are mentioned by Mr. Angove, who reports that one of the latter is 80 feet deep, and on a cross reef four feet wide. The amphibolite in the shaft on the boundary between the two leases shows in places a modification towards siderite or spathic iron [**6025**], *see* return for 1897. Both these leases became void in August, 1898. The G.M.L. 44 became the **St. Patrick East**, G.M.L., 895 of six acres, in 1903. Next southerly was the MORNING STAR, G.M.L. 54; it has several shafts on the underlay of the main north and south reef from 210 to 150 feet in decomposed rock. This was forfeited in March, 1898; subsequently the GIFT, G.M.L. 706, which existed as such until November of 1900, when it became subsequently the NORTHERN STAR, G.M.L. 821, which is still in force. The reef has well-defined walls, at the south end of the lease it is three to five feet thick. From three inches to six inches of the footwall side has thin laminated quartz [5090], which carries visible gold; there is very little pyriteous stone, which occasionally carries a little carbonate of copper. The chute of pay ore dips in an irregular manner to the north, only the richer portions of the stone being raised, so that the stoping is mostly irregular. To the south of this was the SCANDINAVIAN, G.M.L. 151. Mr. Angove states that one shaft was sunk 85 feet vertically and 40 feet on easterly underlay, the reef in bottom being two feet six inches wide, and another shaft 80 feet on the underlay. Having been forfeited in November 1898, it eventually became in part the GLASGOW, G.M.L. 727, from which some small crushings were obtained, which may be found in the table appended. The Glasgow was forfeited, in 1899, when it then became the SCANDINAVIAN, G.M.L. 796, from which a small crushing was obtained. The reef appears to cut out here, and although a number of leases were taken up on the probable line of reef no trace of it has been found between this and the Norseman No. 1 North, about 30 chains to the south.

The following table gives the returns from the Northern Star line of reef:—

Table showing the Yield of the Northern Star Reef.

NORTHERN PORTION.

Year.	Name and No. of Lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897	Bohemian, 124 ...	...	17·50	...	...	10·00	Bevilaqua.
1898	Jessie Margaret, 177	...	24·00	...	...	4·00	
1897 ...	Sudden Norseman, 44, 139	...	249·00	...	...	143·00	
1899 ...	Q.C. 27, 44 ..	...	77·00	...	...	8·60	State Battery
1899 ..	Unregd. Q.C., on 44	...	22·00	...	...	5·50	Bevilaqua.
1899 ..	Do. ...	...	90·00	...	...	33·55	State Battery
1901 ...	Unregd. Q.C., Biddler, on 44	...	18·00	...	...	11·40	State Battery
1901	Unregd. Q.C., Hunter, on 44	...	12·00		...	4·70	State Battery
1901	Unregd. Q.C. Morgan, on 44	...	18·00	13·00	5·09	8·00	State Battery
1902	...	...	..	...	...	...	
1903	Q.C. 127 ...	...	29·50	...	...	5·45	State Battery
			557·00	13·00	5·09	234·20 5·09	
						239·29	or ·429 ozs. per ton.

Table showing the Yield of the Northern Star Reef—continued.

SOUTHERN PORTION.

Year.	Name and No. of Lease.	Ozs. Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Morning Star, 54	...	239·00	...	...	70·55	Bevilaqua.
1898 ...	Gift, 706 ...	...	196·00	...	...	81·68	
1199 ...	Do. ...	...	472·00	...	...	348·45	
1900 ...	Do. ...	...	20·00	...	...	3·56	
1900 ...	Do. ...	...	...	118·00	19·66	...	State Battery
1901 ...	Northern Star, 821	...	149·00	...	...	105·87	
1902 ...	Do. ...	190·65	112·50	...	...	160·98	
1902 ...	Do. ...	...	...	292·00	51·97	...	State Battery
1903 ...	Do. ...	86·80	177·50	...	...	324·75	
1903 ...	Do. ...	...	...	89·25	23·63	...	State Battery
1904 ...	Do. ...	...	100·50	...	...	325·20	= 264·92 F.
1904 ...	Do. ...	143·27	...	...	...	...	= 115·33 F.
1904 ...	Do. ...	...	...	87·08	37·00	...	State Battery
1898 ...	Glasgow, 727 ...	...	20·00	...	...	8·50	Bevilaqua.
1899 ...	Do. ...	...	34·05	...	...	29·67	
1899 ...	Scandinavian, 796	...	14·00	...	...	9·25	State Battery
1900 ...	Do. ...	...	20·00	...	...	2·36	State Battery
		420·72	1,554·55	586·33	132·26	1,470·82 132·26 420·72	
						2,023·80	or 1·302 ozs. per ton.

The Norseman Reef.

The Norseman Reef outcrops along the west side of the Norseman Hill for a distance of 7,000 feet underlying at an average angle of 45 degrees to the east, and has been proved to a vertical depth of 400 feet. The reef is of considerable thickness throughout, ranging up to eight feet in leases 19 and 21. The chutes of quartz are mostly horizontal, and extend for 400 and 500 feet in the workings at the southern end. The quartz is mostly very white where the reef is large, but it is well mineralised in the Viking workings where the best values have been hitherto obtained. The leases along this reef are taken in sections, for the sake of convenience of reference to the tables of crushings.

At the north end are the NORSEMAN No. 1 NORTH, G.M.L. 16, and the NORSEMAN No. 1 NORTH BLOCK WEST, G.M.L. 482, both of 12 acres; these were amalgamated, and both at a later date, with the Mt. Barker Reward G.M. in November of the same year, and designated the New No. 1 North Norseman G.M. Co. The North end of the reef has been generally considered to be cut off abruptly, but I did not find this to be the case, the quartz in the lower levels tapering out into seams of ironstone and oxidized schist, the point of ending dipping to the north. The reef is mostly from one to three feet thick, but averaging about two feet. The main shaft is 310 feet on an underlay of about 35 degrees flattening out to 25 degrees at the bottom; there are levels of 103, 200 and 300 feet. The south shaft is 180 feet deep. North of the shaft the reef is about three feet thick, this is the north chute [5914]. North of this it narrows and becomes vuggy, the cavities being five or six inches wide and many feet long, partly empty, with siliceous sinter ramifying through them [5912], the reef then tapers out dipping north. South of the main shaft it is again two feet six inches thick, and a break of three to eight feet occurs caused by a fold in the reef, the stone then makes again forming a south chute. Their dip to the north is about 35 degrees. The pay ore is mostly confined to three feet or four inches of the underlay side of the reef, as in the Morning Star. The reef appears to have followed the course of an intrusive porphyry [5913] dyke one foot to two feet thick. It occurs in the hanging wall of the reef south of the main shaft and in the footwall to the north of the shaft; the dyke has been found to be an indicator of gold in the reef. The country rock is amphibolite, somewhat schistose near the reef [5915]. The mine is being worked on a 5 per cent. tribute. A plan of the mine should be in existence but I was not able to find its whereabouts.

The following table gives the total gold yield of the portion of the Norseman reef:—

Table showing the yield of the Norseman Reef (part).

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Norseman No. 1 (North) 16	...	501 00	...	...	509·05	
1898 ...	Norseman No. 1 (North) 16, 482, 685	...	1,182·00	...	...	589·00	
1899 ...	Do. ...	..	891·00	...	...	475·95	
1900 ..	Do.						
1901 ..	Do.	...	489·00	...	...	438·39	
1902 ...	Norseman No. 1 (North) 16	...	258·50	...	...	104·17	
1902 ...	Do. ...	...	...	243·50	25·10		
1903 .	Do. ...	7·55	179·00	...	...	202·85	
1903 ...	Do. ...	...	...	97·33	16·26		
1904	Do.	...	91·00	.	...	118·74	= 98·69 F.
1904 ..	Do. ...	3·75	..	90·25	18·69	...	State Battery = 2·95 F.
		11·30	3,591·50	431·08	60·05	2,378·15 60·05 11·30	
						2,449·50	or ·682 ozs. per ton.

Next is the Norseman, G.M.L. 15, where L. Sinclair discovered this reef in July, 1894, and which was forfeited in August, 1899. The lease surrounds his Reward Claim No. 3 on three sides. The two properties were worked jointly, together with the Norseman West, G.M.L. 149 on the west side. The workings were inaccessible at the time of my visit. There are three principal shafts which Mr.

Angove states had been sunk on a reef three feet thick. The main shaft is 280 feet on the underlay, with drives at the 50-foot level, but very little stoping is said to have been done. There are several other minor underlay shafts on this reef. The quartz is mostly very white. The northern portion became the **Norseman**, G.M.L. 758, but was voided in August of 1901, and subsequently became Q.C. 93 held by W. R. Pybus from August of 1901 and resumed in January, 1904. The southern portion of G.M.L. 15 became the **Golden Calf**, G.M.L. 761, from September of 1899, and the Reward Claim became the **Norseman Reward**, G.M.L. 740, from April of that year; it was forfeited in November and became the **Priscilla**, G.M.L. 792, from December until it subsequently became in part Q.C. 74 held by T. C. Ellis from October, 1900, to its surrender in November, 1903. The yield of this portion of the Norseman Reef is given in detail in the table below:—

Table showing Yield of the Norseman Reef (part).

Year.	Name and No. of lease	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Norseman 15 ...	...	238·00	...	...	130·70	
1898 ...	Norseman G.M. Co., N.L., 15,149	...	128·00	...	...	40·03	
1899 ...	Norseman 15,149	...	30·00	...	...	12·80	
1901 ...	Q.C. 93	...	24·00	36·00	6·52	12·60	State Battery
1901 ...	Q.C. 95	...	9·00	...	...	2·00	Do.
1900 ...	Golden Calf 761 ..	...	92·00	...	...	74·15	
1900 ...	Unregd. Q.C. Pybus, 761	...	12·00	...	...	4·85	Do.
1901 ...	Unregd. Q.C. Pybus, 761	...	...	17·00	2·68	...	Do.
1901 ...	Unregd. Q.C., C. Thomas	...	44·00	8·00	·69	17·87	Do.
1901 ...	Unregd. Q.C., Happy-go-Lucky, McAndrew	...	6·50	...	...	9·72	Do.
1900 ...	Unregd. Q.C., Union, Knive	...	10·00	...	...	5·30	Do.
1901 ...	Q.C. 66 and 92 ...	...	183·00	41·00	6·16	87·18	Do.
1898 ...	Norseman Reward, 740	...	110·00	...	...	27·56	Bevilaqua
1899 ...	Do. ...	...	191·51	...	...	118·77	State Battery
1899 ...	Priscilla 760 ...	...	40·00	...	...	81·70	
1900 ...	Do 792 ...	...	68·50	...	...	35·45	
1900 ...	Q.C. 74, on 792 ...	...	12·00	8·00	·97	6·88	Do.
1901 ...	Do. ...	...	—	—	—	—	
1902 ...	Do. ...	...	...	22·50	3·02	...	Do.
1903 ...	Do. ...	...	146·00	...	...	75·29	Do.
			1,434·50	132·50	20·04	742·85 20·04	
						762·89	or ·5318ozs. per ton

The next lease on the same line of reef is the **Norseman** No. 1 **South**, G.M.L. 17, which was held by the Royal Dane G.M. Co. It has a commanding situation on the top of the Norseman Hill. Quite a network of quartz porphyry dykes occurs at the north end of the lease, and the reef takes a sharp bend due evidently to this cause, the dykes being prior origin to the quartz. There are three shafts of about 45 degrees on the underlay. The middle one is the main shaft, but the workings are inaccessible. Mr. Catlin states that the depth is 320 feet, and that the reef was of large size all the way down, and is five feet at bottom of the shaft; a little water, about 400 gallons a day, was making at that depth; at 120 feet a drive was put in 34 feet north. The south shaft was put down 70 feet for prospecting purposes. The north shaft is 200 feet with drives at 50 feet level, 103 feet south and 187 feet north. In the south drive the reef is eight feet or nine feet wide; at the bottom of the shaft the reef is eighteen inches. The quartz is very white and of low grade but more pyritous lower down, as is also the country rock, which is similar to that further north.

This lease was amalgamated with the NORSEMAN No. 1 SOUTH BLOCK CLAIM, G.M.L. 57, but was voided in October, 1899, and was subsequently the CELT, G.M.L. 776, which became forfeited in July, 1900.

The crushings from this portion of the reef, the details of which are shown in the table below, show an average of about one half an ounce per ton.

Table showing Yield of the Norseman Reef (part).

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Norseman No. 1 South 17, 57	...	78·00	...	...	26·30	
1898 ...	Do. ...	...	250·00	...	...	45·95	
1899 ...	Do. ...	...	—	—	—	...	
1900 ...	Do. ...	...	..	—	97·29	...	
1900 ...	Celt 776	...	34·00	...	...	10·90	
1900 .	Q.C. 65	...	31·00	...	...	17·91	State Battery
1901 ...	Govt.	...	20·00	...	...	5·28	Do
1901 ...	Q.C. 96 and 101 ...	...	45·60	13·00	2·91	13·50	Do.
1902 ...	Do. ...	...	21·50	...	...	11·63	Do.
1902 ...	Unregd. Q.C., Thomas	...	17·50	...	...	27·75	Do.
		...	498·50	13·00	100·20	159 22 100·20	
						259·42 or ·5204ozs. per ton	

Southward from the Celt, the Norseman reef is to be seen for nearly a mile in the Norseman G.M. Co.'s leases, whose 12 leases total 180 acres 1 rood 7 perches; these were mostly taken up in August, 1894, and were amalgamated with the United Scotchman Co. in July, 1897, which company held three leases—22, 24, and 103 (47). The reef is a fine body of stone, but has proved to be of low grade. The mine practically ceased operations in 1901, and it is at present being worked by a few tributers, who appear to be satisfied with their proceeds, so that this should be a good indication for the future resuscitation of the mine. The quartz is mostly white and slightly blue in tint without much pyrites except at the bottom of the Viking lease workings. There is a considerable amount of silver present in the reef, apparently due to the presence of galena. Calcite occurs frequently [5972], associated with the quartz [5974]; mineral fat [5993] occurs near the main shaft, in addition to small quantities of asbolite. The country is amphibolite [5975], which, as is usual about here, is slightly schistose or foliated near the reef. The workings of this mine are shown on Plate II.

The following extract is from page 58 of Bulletin No. 6, by Mr. E. S. Simpson, regarding a sample of this mineral fat collected by the Government Geologist, some years ago :—

"*Mineral fat.*—A clay having when freshly extracted the consistency of tallow is found in vughs in the reef at the Norseman Gold Mines, Ltd., Norseman. It is faintly greenish in tinge when fresh and moist, but on exposure to the air changes in colour to brown and loses water rapidly, becoming first waxy and then dry and granular in consistency. Its composition was found to be :—

	Wet Mineral.	Dry Mineral.
Water H_2O lost over sulphuric acid ...	49·17 ...	...
„ „ lost on subsequent ignition ...	9·80 ...	19·08
Silica, SiO_2	20·30 ...	39·53
Alumina, Al_2O_3	18·03 ...	35·11
Ferrous Oxide, FeO	·44 ...	·86
Manganous Oxide, MnO	Trace ...	Trace
Lime, CaO	·15 ...	·29
Magnesia, MgO	·22 ...	·43
Potash, Ka_2O...	·05 ...	·10
Soda, Na_2O	2·36 ...	4·60
	100·52 ...	100·00

"This would correspond to the formula $Al_2O_3 \cdot 2SiO_2 \cdot 3H_2O + 15H_2O$.

"The formulæ given by Dana to the only four minerals approaching this in composition, are :—

Halloysite ...	... $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O + nH_2O$; or $Al_2O_3 \cdot 2SiO_2 \cdot 3H_2O + nH_2O$
Newtonite ...	... $Al_2O_3 \cdot 2SiO_2 \cdot 4H_2O + H_2O$
Montmorillonite	... $Al_2O_3 \cdot 4SiO_2 \cdot H_2O + nH_2O$
Kaolinite ...	.. $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$

"The Norseman mineral agrees exactly in formula with halloysite, although in outward appearances it resembles more closely some forms of montmorillonite."

The northern leases 19, 20, and 21 were worked by three adits to which underlay shafts connected. In the Sydney Norseman, G.M.L. 20, the upper adit is 550 feet along the line of reef, and passes through a quartz porphyry dyke; the reef ranges up to five feet six inches thick. The quartz is blue white, and slightly ferruginous in places with occasional black incrustations, which has been determined in the Departmental Laboratory to be asbolite, a cobaltiferous manganese oxide [5971-5973]. The reef ranges up to five feet six inches thick; a little stoping has been done between the adit and the surface, where the reef bifurcates. In the Cachuanca[*], G.M.L. 19, the middle adit cross cuts to the reef 130 feet, and a drive then follows the reef about 300 feet north and south, passing through several quartz porphyry dykes. The quartz is whiter here, and is from three to seven feet wide in the south drive, and stoping has been carried to the surface. In the Hardy Norseman, G.M.L. 21, the lower adit is 500 feet long; it crosses several quartz porphyry dykes. The reef is up to eight feet thick, a whip shaft and also winze goes down about 24 feet below the adit, and stoping has been done to the surface, quite a rich patch having been found here by the tributers. A small fissure occurs here, dipping about 32 degrees to the north, with nodules of magnesite in it; possibly some of the gold may have been of secondary origin [5970, 5974]. The company's main shaft is on the Mildura Norseman, G.M.L. 18, and is 550 feet on an underlay of about 45 degrees, making a vertical depth of 390 feet. The bulk of the workings are in the oxidized zone, and above the 200 feet level. They extend 300 feet north, and 500 feet south to the Scotchman shaft, and most of this is stoped. The chute dips slightly to the south. The average width of the reef here is 3 feet 6 inches. The reef intersects several quartz porphyry dykes; one in the drive south of the shaft is slatey [5969], and another north of the shaft is pyritous and of a greenish colour. Between the 200 and 400 feet levels poor values only were obtained; below this, however, they improved. The lower portion of the shaft was inaccessible to me on account of water, which is only soakage from the surface. Mr. Catlin's report states that there is 3 feet thickness of quartz at the bottom. Between these and the next workings in the Viking Norseman a large dyke of quartz porphyry occurs, with offshoots on its southern side. A split in the reef also occurs south of the dyke, and the westerly arm has been worked for a short distance. The Viking Norseman, G.M.L. 26, was taken up by A. Forbes and party in September, 1894, and it passed into the hands of A. L. Simon, who sold it to the Norseman G.M., Ltd., in March, 1896, for the sum of £10,000. The Viking shaft has a depth of 574 feet on underlay, or a vertical depth of 415 feet. The principal workings extend north 550 feet, and range down to 380 feet depth at the shaft, with stopes on the chute of ore. The oxidized zone also takes a dip here, showing that this is the cause of the erosion of the gully above in the hillside. The reef ranges from a few inches to 5 feet, and probably averages 2 feet; it has frequent inclusions of country rock. The quartz is here of higher value than elsewhere in the mine, and shows gold in places, and is very pyritous in the lower levels. A £ for £ subsidy was granted by the Government towards the deeper sinking of this shaft, the intention being to go down to 700 feet, but only 124 feet was so sunk.

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[*] A misspelling of *Cachucha*, the name of a Spanish dance.

In the Annual Report of the Geological Survey for the year 1900, p. 26, the Government Geologist reported as follows:—

"A careful inspection of the Viking workings was made, and especial attention paid to the reef in its lower levels. At 440 feet the reef consisted of about three feet of quartz, carrying a small quantity of pyrites and galena. During my visit the shaft was deepened about four or five feet to enable me to see the character of the reef. The face showed about three feet of quartz, carrying sulphides of iron, zinc, and lead. An unsophisticated sample of the whole face, collected under my own supervision, yielded in the mine laboratory a free milling value of about 12dwts. of gold to the ton. A fire assay of the more highly mineralised portions of the same stone yielded, in the official laboratory in Perth,—

Gold	1oz. 0dwts. 9grs. per ton.
Silver	1oz. 2dwts. 0grs. per ton.

"The relatively large proportion of galena in the sample may be held accountable for the high silver contents. Free gold shows in some of the stone from the face, and specimens are now in the possession of the Department."

and again in the report for 1901, p. 20:—

"NORSEMAN GOLD MINES, LIMITED.—As alluded to in my report of last year, financial assistance was rendered to this company, to enable them to explore the deep levels by sinking the Viking shaft from 450 feet to 700 feet. The following table gives the particulars of assays made in the Departmental Laboratory as the work proceeded:—

Lab. No.	Depth in feet.	Assays.
3020	460	Gold, 20grs. per ton; silver, 2dwts. 11grs. per ton.
3021	470	Gold, trace; silver, 2dwts. 11grs. per ton.
3022	480	Gold, trace; silver, *nil.*
3023	490	Gold, trace; silver, 2dwts. 11grs. per ton.
3024	500	Gold, 1oz. 16dwts. 18grs. per ton; silver, 3ozs. 19dwts. 5grs. per ton.
3025	510	Gold, 2dwts. 11grs. per ton; silver, 15dwts. 12grs. per ton.
3026	520	Gold, 20grs. per ton; silver, 1oz. 3dwts. 16grs. per ton.
3268	530	Gold, 20grs. per ton; silver, 20grs. per ton.
3269	540	Gold, 20grs. per ton; silver, trace.
3270	550	Gold, 3dwts. 6grs. per ton; silver, 4dwts. 22grs. per ton.
3271	560	Gold, trace; silver, *nil.*
3272	574	Gold, 20grs. per ton; silver, 20grs. per ton.

The table appended gives details of the crushings of this portion of the Norseman Reef:—

Table showing the Yield of the Norseman Reef (part).

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
Previous to 1897	United Scotchman G.M., 22, 24, 239	...	1,694	...	...	1,602	
1897 ..	Do. do. ...	...	1,628	...	...	1,532·70	
1897 ...	Norseman G.M. Co., 18, 19, 20, 21, 26, 48, 94, 101, 103, 115, 116, 138, 235, 236, 611	...	2,499	...	...	2,854·68	
1898 ..	Norseman G.M. Co., 12, 18, 20, 21, 22, 24, 25, 26, 48, 94, 101, 103, 115, 116, 138, 235, 236, 611	...	9,584	...	...	10,148·28	
1899 ...	Norseman G.M. Co., 18, 19, 20, 22, 24, 26, 48, 94, 101, 115, 116, 138, 235, 236, 239, 611	...	24,655	...	...	10,755·08	
1900 ...	Do. do. ...	...	24,331	...	...	8,471·44	10,821·01
	Do. do. ..	...	...	10,302	2,349·57	...	
1901 ...	Do. do. ...	...	11,424	...	...	3,735·21	7,366·50
	Do. do. ...	...	...	18,699	3,631·29	...	
1902 ...	Norseman G.M. Co., 18, 19, 20, 21, 22, 24, 25, 26, 48, 116, 138, 611	...	1,983	...	...	1,897·41	4,631·31
	Do. do. ...	...	...	19,152	2,733·90	...	
1903 ...	Do. do. ...	...	1,355·5	...	...	916·86	2,137·34
	Do. do. ...	...	...	7,279	1,220·48	...	
1904 ...	Do. do. ...	...	155·5	...	...	79·86	—{66·59 F. 2·00 Silver
	Do. do. ...	...	...	441	128·38	...	—{71·49 F. 46·88 Silver
		...	79,309·0	55,878·0	10,063·62	41,993·52 10,063·62	
						52,057·14	or ·6563 ozs. per ton

The Royal Standard Norseman Reef.

To the west of the Viking was the Royal Standard Norseman, G.M.L. 100, of 12 acres, in which there is a reef north-east and south-west about two feet six inches thick at outcrop, underlaying 58 degrees southerly, on which a shaft has been sunk. This may be one of the branches into which the Norseman reef appears to split up. The property was forfeited in October, 1896, and subsequently became the Royal Standard, G.M.L. 599, on which a shaft 40 feet was sunk. No returns have been obtained from this reef.

The Ophir Reef.

South of this was the Ophir Reef, a cross reef which has been traced for about 1,800 feet to the south end of the Valkyrie. It underlays south about 55 degrees, and has yielded good values. At the western end was the Ophir, G.M.L. 98, in which three underlay shafts have been sunk in addition to a vertical shaft; according to Mr. Angove, No 1 is 78 feet, with drive east 34 feet and west 46 feet; the lode is from 18 inches to 20 inches in the east drive and two feet six inches in the west. No. 2 shaft west is 70 feet on underlay. No. 3 is 30 feet on underlay, the reef in bottom being two feet six inches wide; on the north boundary a shaft is down 20 feet on another reef. The Ophir was forfeited in March, 1898, it subsequently became the NEW OPHIR, G.M.L. 707, but was abandoned in April of the succeeding year. From April, 1899, Q.C. 38 was held by M. Kiwru, but was five months later the OPHIR, G.M.L. 847, was subsequently taken up and held from October, 1901, to to July, 1902.

The reef then passed into the OLD SAXON NORSEMAN SOUTH, G.M.L. 30, which is traversed by a small north and south reef with four shafts, which may be a spur of the Norseman reef. Mr. Angove states that one shaft is 40 feet vertical and 90 feet on the underlay, and that the reef is one foot wide, the other shaft is 40 feet, with a drive 240 feet, and two other shafts 25 feet and 35 feet.

Next adjoining was the PALPARAIA NORSEMAN, G.M.L. 110, in which there is an underlay shaft 40 feet Both these two properties became in part the SUSSEX, G.M.L. 627. Records show that the main shaft intersected the reef at 130 feet, and at 170 feet water was met with which stopped further sinking. The Sussex was voided in October, 1898. South of this was the SOVEREIGN, G.M.L. 785, which after being voided in September, 1900, subsequently became the SOVEREIGN, G.M.L. 826, in which several underlay shafts were sunk on the Ophir reef; this lease ceased to exist in August, 1902. The yield of the various holdings on the Ophir reef is given in detail in the table below:—

Table showing Yield of the Ophir Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
Previous to 1897	Ophir 98	...	118·00	...	...	400·00	
1897 ...	Do.	...	504·75	...	...	371·00	
1898 ...	New Ophir 707 ...	...	38·00	...	...	24·80	
1199 ...	Q.C. 38	...	13·00	...	...	7·75	State Battery.
1901 ...	Ophir 847	...	8·00	...	...	10·45	
				6·00	2·81	...	Do.
1900 ..	Sovereign 785	...	19·00	...	...	29·15	
1901 ...	Do. 826	...	102·00	...	...	99·20	
				23·00	7·25	...	Do.
1902 ...	Do.	...	38·00	...	...	29·76	
				34·00	8·02	...	
			840·75	63·00	18·08	972·11 18·08	
						990·19	or 1·1777 ozs. per ton.

Valkyrie Reef.

About seven chains east of the Viking Norseman is the north end of the Valkyrie Reef which has a north and south course of about 1,000 feet underlaying east, but at a somewhat flatter angle than the Norseman reef; it has been tested to a vertical depth of 140 feet and has a good body of stone but is irregular and patchy.

Three shafts have been sunk on it in the No. 1 St. Agnes Extended, G.M.L. 113. A cross reef also occurs where the gully crosses the main reef line. The property subsequently became in part Q.C. 115, a crushing from which is included in the table with the Agnes Venture Reef.

The next lease to the south on the Valkyrie reef was the St. Agnes, G.M.L. 29, taken up by Mr. Holman in September, 1894. This and the St. Agnes South, No. 1, G.M.L. 35, were held by an English Company, St. Agnes Gold Reefs, which was floated at the end of 1895. To these were added the St. Agnes Block, G.M.L. 189, in October, 1896, the St. Just, G.M.L. 483, the Bonanza, G.M.L. 36, and the Bonanza Block, No. 1, G.M.L. 480. These two last, however, were on the Bonanza Reef, which is an east and west reef and will be described next. They were forfeited in May 1901. Any gold that may have been obtained from these two leases at this period was merged into the yield of the Valkyrie Reef.

A line of pipes was laid down to Lake Cowan and a battery of 10 stamps erected; crushing was commenced at the end of 1897. The Company stated in 1898 that they had spent £23,000 on the property and had done 803 feet of sinking and 728 feet driving. In 1898 the Company had to go into liquidation, and the two first-named leases were forfeited in October, 1899, and the St. Just in June, 1899, and the two last in December, 1898. Leases 29, 35, and 189 became in part the Viking South, G.M.L. 778. Evidence was given before the warden in December, 1900, that the mine had four shafts 265 feet, 75 feet, 40 feet, and 108 feet, with 750 feet of main drives and 2,500 tons of stone stoped out; the stone so far had yielded only poor results. The property was, in May, 1901, forfeited. It subsequently became in part Valkyrie, G.M.L. 831, of five acres, which was amalgamated, in December, 1903, with Valkyrie North, G.M.L. 853, Valkyrie Extended, G.M.L. 880, Valkyrie West, G.M.L. 886, under the name of the Valkyrie G.M. Co. The workings of this Company were in progress at the time of my visit, and are shown on Plate 4. There are several underlay shafts along the outcrop of the reef, the main shaft is at the south end of G.M.L. 29. At the 60-feet level of this shaft, the underlay is 40 degrees and it gradually lessens as depth is increased until, at 240 feet, it is only 15 degrees. The reef is very contorted and varies greatly in thickness from five feet to a few inches. The gold occurs in bunches and appears where the reef has broken through the quartz porphyry dykes or where the quartz porphyry forms the hanging wall [**5598**, **5599**]. The quartz porphyry hereabouts, it should be noted, is very pyriteous; the country rock is a very compact amphibolite [**5594**] with convolutions of a harder and coarser crystalline variety [**5595**]. The mine had a chequered career which appears to have been caused chiefly by bad financing. G.M.L.'s 831, etc., were surrendered in January, 1905, and then became part of the VALKYRIE CONSOLIDATED, G.M.L. 936, which now exists.

The yield of the Valkyrie Reef is to be found in the table below:—

Table showing the Yield of the Valkyrie Reef.

Year.	Name and No. of Lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	St. Agnes Gold Reefs, 36, 480, 483	...	430·00	...	...	329·65	
1898 ...	St. Agnes Gold Reefs, 29, 35, 189, 483	...	1,080·00	...	...	593·80	
1899 ...	St. Agnes Gold Reefs, 29, 35, 189, 483, M.A. 7	...	324·00	...	...	217·62	
1899 ...	Valkyrie South, 778	...	124·00	...	...	137·00	
1900 ..	Do. ...	...	381·00	...	...	282·60	
1901 ...	Do. ...	...	38·00	...	...	6·90	
1901 ...	Valkyrie, 831 ...	...	52·00	...	...	80·27	
1902 ...	Do. ...	142·64	85·00	...	..	174·86	
1902 ...	Do. ...	...	...	47·75	8·37	...	State Battery
1903 ...	Do. ...	33·42	21·00	...	...	148·55	
1903 ...	Do. ...	...	...	30·00	6·73	...	State Battery
1904 ...	Valkyrie Leases, 83, etc.	...	621·00	...	...	819·85	=721 F.; 18·40 Silver
1904 ...	Do. ...	...	...	125·00	21·22	...	State Battery
1904 ...	Do. ...	107·15	...	...	...	...	= 93·71 F.
1904 ...	Unregd. Q.C., Fowler	...	6·00	...	..	7·59	= 6·38 F.; State Battery
1904 ...	Unregd. Q.C. 166, Waterloo	...	6·50	...	...	11·30	= 9·31 F.; State Battery
1904 ...	Do. ...	...	...	4·00	1·23	...	
		283·21	3,168·50	206·75	37·55	2,810·09 37·55 283·21	
						3,130·85	or ·988 ozs. per ton

Bonanza Reef.

Immediately to the south of the Valkyrie Consolidated is the Bonanza Reef which extends east and west for nearly 500 feet, underlaying south 40 degrees. It crosses the main quartz porphyry dyke from the Valkyrie mine; at this place it is from one to four feet thick, and has been tested to a depth of 60 feet. The quartz porphyry is very pyriteous. There are several other subsidiary reefs adjacent to this main reef. G.M.L's. 36 and 480, Valkyrie leases, became subsequently the NORSEMAN SOUTH BONANZA, G.M.L. 731, which was forfeited in May, 1901; subsequently unregistered Q.C., held by Mr. Miller, was taken up, which gave place to the BONANZA, G.M.L. 829; this having been forfeited in April, 1902, eventually became the BONANZA, G.M.L. 859, and subsequently TAUMUTU G.M.L. 865. In 1903, Q.C. 121 was held by Mr. Fitzgerald for one month; but later on the **Ajax**, G.M.L. 882, was taken up. Altogether four shafts have been sunk on the reef, 45 feet, 40 feet, 30 feet, and 60 feet deep; at the latter the reef is stoped from the 60-feet level to the surface for 80 feet in length, it being richer here at the dyke crossing than elsewhere.

To the west of the above was the **Great Norseman Junction** G.M.L. 242, in the north-west corner of which Mr. Angove reported a vertical shaft of 50 feet; others have since been sunk in the south-west and south-east corners. It was abandoned in October, 1896. The south-east portion was subsequently the **Klondyke**, G.M.L. 693, which became void in October, 1898. On the east side of the last was the **St. Agnes and Norseman Junction**, G.M.L. 268, which was forfeited in August, 1896, and then re-numbered 742, and became void in August, 1900. To the east and south of these were two leases on which no work was done. The various details of the Bonanza Reef are given in the table below.

Table showing the Yield of ths Bonanza Reef.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1898 ...	Klondyke, 693 ...	...	15·00	...	...	11·25	
1899 ...	Norseman South Bonanza, 731	100·00	211·00	...	...	617·62	
1900 ...	Do. ...	...	...	...	...	...	
1901 ...	Do. ...	...	50·00	...	...	14·23	
1901 ...	Unregistered Q.C., Miller	...	15·00	...	...	4·54	State Battery
1901 ...	Bonanza, 829 ...	...	67·00	...	...	28·56	
1903 ...	Q.C., 121 ...	...	7·00	...	...	10·54	
1903 ...	Ajax	...	...	4·00	2·18	...	do.
1903	Do., 882 ...	...	22·50	...	...	28·58	
1904 ...	Do., 882 ...	...	181·00	...	...	177·76	— { 2·88 Silver 143·59 F. 3·90TF.
1904 ...	Do. ...	...	41·42	...	126·16	22·76	State Battery
		141·42	568·50	130·16	24·94	893·08 24·94 141·42	
						1059·44	or 1·863ozs. per ton

Note.—If the returns of the Valkryrie and Bonanza Reefs are taken together the yield is equal to 1·124ozs. per ton.

Mount Barker Reef.

Nearly half a mile eastward of the north end of the Norseman Reef is the Mount Barker Reef, which has a strike of about 80 degrees, and has been traced for a distance of 1¼ miles. It underlays to the east 60 degrees and more, and has been tested to 175 feet vertically below the surface. It has only yielded, however, 354ozs. of gold.

The north end of this reef was occupied by the **Highfield**, G.M.L. 121. Mr. Angove states that the shaft near the south end is 90 feet, and another on west boundary 25 feet deep respectively.

The property subsequently became G.M.L. 527, under the same name, but was forfeited in September, 1897, and later on became in part the **Mt. Barker** No. 6 **North**, G.M.L. 668, from which there are no crushing returns. The reef outcrops in parallel lines on the west boundary, showing a strong body of stone. On the east side there is a very much crushed quartz-porphyry dyke [**5612**]. On the east side of the dyke there is an ironstone formation outcropping. There is a vertical shaft here 90 feet and an underlay 25 feet further north. This seems a locality worthy of more trial.

Next south is **Mt. Barker** No. 5 **North**, G.M.L. 109. There are three shafts here. Mr. Angove states that No. 1 shaft is 175 feet deep on easterly underlay on a reef which is four feet wide at the bottom. No. 2 is 70 feet and No. 3 30 feet deep on a reef three feet wide at the surface, but which has increased to seven feet at the bottom. The property subsequently became the **Bulletin** G.M.L. 846, from the reef in which a small crushing was obtained, particulars of which are to be found in the table.

Next south was the **Mt. Barker** No. 4 **North**, G.M.L. 107. The reef outcrops here near the centre of the lease, and there are three shafts upon it. Mr. Angove states that No. 1 shaft is 110 feet deep, and at 50 feet a drive goes 12 feet north on a lode (schistose formation) 12 feet wide; No. 2 shaft, on north part of lease, has been carried down 60 feet on a reef about two feet wide; No. 3 shaft is sunk 60 feet vertically. The lease was forfeited in September, 1897. Subsequently an unregistered Q.C., held by Mr. H. Parker, was taken up upon it, and Q.C. 133, **Dead Finish**, held by Mr. Fitzgerald and party, from which there have been several small crushings, particulars of which are to be found in the table.

On the west side was the **Coromandel**, G.M.L. 465, which subsequently became in part Q.C. 141, held by Woolford and party. Next south, was the **Mt. Barker** No. 3 **North**, G.M.L. 102. There seems to be two lines of lode here. The one on the west boundary has two vertical shafts of about 30 feet; the other lode has two shafts. One of these, Mr. Angove states, is 120 feet deep on an easterly underlay, the other, 100 feet deep, with drive 82 feet west to the other shaft, and also a drive on lode at the bottom; the lode formation, he says, is 12 feet wide. This lease belonged to the Norseman G.M. Co. in 1898, and there is no separate record of any crushing; it became void in November, 1898.

South of this was **Mt. Barker Extended** No. 2 **North**, G.M.L. 40, of 12 acres. Mr. Angove's account states that the main shaft was 90 feet vertical, and at 40 feet a crosscut west was 55 feet to main lode (this shaft, the writer understands, was subsequently deepened to 120 feet), and thence a drive along the lode 25 feet; another shaft was 80 feet on an easterly underlay (of 63 degrees) on the main lode with a drive 25 feet; another, 50 feet ditto on a parallel lode. Foul air was complained of in these workings. The formation here is schist with quartz and ironstone, a sulphide lode evidently; the yield of this lode is shown in the table of returns. Q.C's. 145 and 146 were taken up hereabouts by Evans and party in September, 1903, and became void in November, 1898; subsequently the ground became in part Nil Desperandum, G.M.L. 726, but was abandoned in June of 1899. South again was the Mt. Barker Welcome No. 1 North, G.M.L. 28. The lode is hidden by the surface material at the gully crossing, but appears strongly on the south side, where it is considerably contorted. Mr. Angove mentions that one shaft is 80 feet, another 82 feet deep, from which depth a crosscut has been driven 80 feet west. Having been voided in November, 1893, it subsequently became Q.Cs.' 104 and 107 and 109, held respectively by Messrs. Garrett and Nugent, and which were surrendered in April, 1903.

To the southward of this was the Mt. Barker, G.M.L. 14, taken up by Mr. R. G. Ramsay, 1894; this and the Reward Claim was worked by the Mt. Barker Reward G.M. Co. These two have two lines of reef; the main reef, 2 feet thick, already described northward, and another, the Agnes Venture Reef, that converges with a westerly underlay. The main shaft was sunk between them on the Reward Claim No. 2, and is down 200 feet. Mr. Catlin states that the first 100 feet is vertical, the rest on the lode, which underlies easterly. At the 100 feet level a drive goes 250 feet north, where it meets an underlay shaft, beyond this it continues 180 feet, where the reef pinches out; between the shafts it was 12 inches to 18 inches wide; from the 50-feet level in this underlay shaft there is a drive 35 feet north on a 12-inch reef and 50 feet south in broken country; from bottom of main shaft a drive goes 25 feet south on an 18-inch reef, where good gold was met with; water was first reached at 136 feet, and at 142 feet the flow was 1,000 gallons a day. No stoping has been done. Further north there is a shaft 65 feet on a very white quartz. The eastern reef was tried by a shaft for 50 feet but the stone gave out; 44 tons from here yielded 12ozs. of gold. There are two small shafts south of the main shaft on either the eastern reef or one parallel to it. There was a battery of ten stamps here jointly owned by this and the New No. 1 North Norseman Company, and there was also a cyanide plant. This lease became void towards the close of 1901, and was subsequently Q.Cs. 113 and 114, held by Messrs. Young and Nugent from August, 1902, to November, 1903; also Q.C. 169, by Mr. H. E. Delamotte for six mouths ending June, 1905. South of this was the Murray Channel, G.M.L. 93, which, however, was abandoned in December, 1895, and subsequently became in part Cornstalk East, G.M.L. 374. There is one shaft 60 feet deep. The Mount Barker Reef appears to terminate here near the crossing of the eastern reef, at least there is no sign of it on the valley flat. Eastward and adjacent to 374 was the Lucky Hill, G.M.L. 369, near the eastern corner of which there is a shaft. Subsequent to the forfeiture of the lease in 1897 Q.C. 103, held by Howard and party, was taken up and held for nearly two years, although, however, the returns show only one small crushing from this locality.

The following table gives details of the yield of the Mount Barker Reef :—

Table showing the Yield of the Mount Barker Reef.

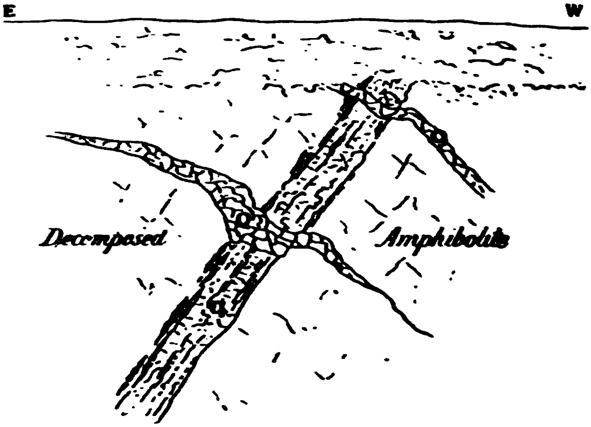
Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1901 ...	Bulletin 846 ...	...	7·00	...	...	2·55	
1902 ...	Do. ...	...	7·00	...	...	3·58	
1902 ...	Unregistered Q.C. on 846	...	7·00	5·00	·89	3·58	State Battery
1897 ...	Mt. Barker No. 4 North 107	...	78·50	...	...	9·00	Bevilaqua
1902 ...	H. Parker on 107	...	11·50	...	...	4·16	State Battery
1902 ...	Q.C. 133, Dead Finish, on 107	...	16·00	...	...	5·60	Do.
1903 ...	Do. ...	...	10·00	8·00	2·21	4·80	Do.
1904 ...	Do. ...	...	7·00	4·00	·59	2·60	Do.
1903 ...	Q.C. 141 on 107 ...	...	10·00	...	...	2·64	Do.
1898 ...	Mt. Barker Extended No. 2 N. 40	...	58·00	...	...	10·80	
1898 ...	Do. ...	...	...	55·20	5·85	...	Do.
1899 ...	Do. ...	...	10·00	...	...	2·35	
1904 ...	Q.C. 145 N. on 140	...	50·00	...	...	27·25	= 23·21 F.
1902 ...	Q.C. 104 to 107, 109, on 28	...	150·00	92·50	24·18	92·12	State Battery
1903 ...	Unregistered Q.C., Richards	...	14·20	...	...	5·04	Do.
1903 ...	Unregistered Q.C., Hoffman	...	85·50	73·00	21·90	54·46	Do.
1904 ...	Unregistered Q.C., Jones	...	25·00	44·10	9·60	13·75	Do.
1897 ...	Mt. Barker Reward 14	...	136·00	...	...	26·10	
1898 ...	Do. ...	...	19·50	...	...	9·00	
1899 ...	Do. ...	...	...	...	..	...	
1900 ...	... ...	...	..	...	...	plates. 4·70	
1902 ...	Unregistered Q.C., Southwell, on 14	...	12·00		...	5·20	Do.
		...	714·20	281·80	65·22	289·28 65·22	
						354·50	or ·494ozs. per ton
1902 ...	Q.C. 103 on 369 ?...	...	30·00	...	...	14·11	or ·470ozs. per ton

Nellie May Reef.

About three-quarters of a mile east from the Record is the Nellie May, G.M.L. 873; here the decomposed rocks are within three feet of the surface, and a very rich patch of gold was found by an open cut on a line of quartz stringers which are intersected by cross veins making quite a network, the gold being found at the crossings of the veins. A shaft was being sunk at the time of my visit to test the ground at a greater depth. On the south-west side there are several outcrops of two parallel reefs trending north-east and south-west, underlaying southerly on which Q.C. 138, held by Campbell and

Smith from July, 1903, to January, 1904, was situated. A shaft was sunk on the reef, which proved very poor.

Fig. 14.



Q. INTERSECTING QUARTZ VEINS NELLIE MAY G.M.L. 873

The details of the crushings shown in the table below indicate that some very rich stone has been raised from this locality :—

Table showing the Yield of the Nellie May Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1903 ...	Nellie May, 873 ...	16·00	76·50	...	...	1392·05	
1903 ...	Do. ...	..	...	28·50	31·62	...	State Battery = 37·12 F.
1904 ...	Do. ...	...	24·50	...	...	40·51	
1904 ..	Do. ...	...	...	6·00	2·26	...	State Battery = 53·64 F.
1904 ...	Do. ...	58·56	...	...	...	...	
1905 ...	Q.C., 138 ...	...	34·00	...	...	6·10	
		74·56	135·00	34·50	33·88	1438·66	
						33·88	
						74·56	
						1547·10	or 11·460 ozs. per ton.

The Pot Luck Reef.

About a quarter of a mile south-west of the Nellie May, was the site of the Pot Luck No. 1 North, G.M.L. 291. A small north and south quartz vein occurs here: no work has been done, and the leases were declared void in November, 1896. South of this was the Pot Luck Extended, G.M.L. 293, of 12 acres, on the same reef, but it was voided in November, 1896.

The Agnes Venture Reef.

The **Agnes Venture Reef** has a course slightly to the east of north, and has been traced from half-a-mile east of the north end of the Mt. Barker Reef. It crosses that reef at the Mount Barker Reward Claim and extends to the east side of the Valkyrie, a distance of three miles; it differs from the reefs hitherto described by underlaying to the west, and, besides the quartz, it is, to a considerable extent, accompanied by a graphitic schist and occassionally by a ferruginous formation. The reef has been tested to a vertical depth of 163 feet. This reef may perhaps indicate the westernmost appearance of the banded quartzite series that appear so extensively to the eastward.

The north end of this line was occupied by the **Brocklesby**, G.M.L. 375, where there was a ferruginous lode formatian, on which a shaft has been sunk, but no particulars of it are available; it is, however, probably about 30 feet deep. There are also two other quartz veins a few chains to the west. Adjoining the south boundary were the **Ironsides**, G.M.L. 294, of 12 acres, and the **Pot Luck**, G.M.L. 230, on a large outcrop of a very white quartz reef, where a 90-feet shaft has been put down on its underlay of 55 degrees; this latter property was voided in October, 1896. South of this was the **Little Beatrice**, G.M.L. 274 in which there is a shaft 60 feet vertical. This also was voided in October, 1896. South again was the **Arcadia**, G.M.L. 214, which appears to have been abandoned in April, 1896. Next was the **Lady Alice**, G.M.L. 238. Mr. Angove mentions that the shaft near the east boundary had been carried down 30 feet on the underlay of the reef, and that drive had been put in 12 feet to the west; also two shafts near the south-east corner, 35 feet, on the reef 12 inches wide. A quartz porphyry dyke occurs here with ironstone. On the west was the **Josephine**, G.M.L. 418. Mr. Angove states that one shaft near the north-east corner is 40 feet vertical, with a drive north 17 feet; another, on west boundary, 25 feet on a cross reef, with a drive east; whilst in the south-west corner another underlay shaft had been sunk 30 feet southerly.

South of 238 was the **Surprise**, G.M.L. 248, where there is one shaft of 25 feet. This was forfeited in September, 1896. On the west was the **Lady Argyle**, G.M.L. 367, upon which there are two shafts. Mr. Angove mentions one is 60 feet, with drive north and crosscut 30 feet west, and the other sunk on an easterly underlay of a reef* which is 6 feet wide. This may be a re-appearance of the Lady Jean Reef.

To the south lay the **Little Rachael**, G.M.L. 136, which had a shaft 56 feet on west underlay and another 35 feet on a parallel lode, in addition to a third of 20 feet deep on a north-west and south-east reef. Having been forfeited in July, 1896, it subsequently became the **Little Rachael**, G.M.L. 528, which ceased to exist as such in January, 1897. South of this was the **Union Jack**, G.M.L. 166. The shaft in the gully, Mr. Angove states, was 90 feet deep, cutting the reef at 80 feet. Another shaft of 30 feet was sunk on a cross reef. The Union Jack was forfeited in October, 1896, though it became subsequently the Union Jack, G.M.L. 588, but ceased to exist in February, 1899.

The reef next appears in the Mt. Barker lease, already described, and passes through the Reward Claim No. 2, crossing the Mt. Barker reef into the CORNSTALK, G.M.L. 119. Mr. Angove states that the north shaft here is 40 feet deep and south shaft 90 feet deep. There is no information to hand as to whether any enrichment of the reefs occurred at their intersection. The Cornstalk ceased to exist in December, 1897.

Next south was the GREAT BOULDER NORSEMAN, G.M.L. 104. An ironstone formation occurs on the boundary between these two leases, underlying west, and a quartz reef on the west boundary, underlying east, on which there is a shaft; the rock adjacent to the reef is schistose. This reef will be described later as the Lady Jean Reef. The shaft on the east boundary, on a cross reef, Mr. Angove states, is 60 feet. A huge outcrop of very white quartz here is probably part of this Agnes Venture reef or lode. The Agnes Venture lode passes southwards from the Great Boulder into the CANNY SCOTCHMAN, G.M.L. 198, where there are two shafts about 50 feet on its easterly underlay. Mr. Angove states that one was 60 feet, with a crosscut 55 feet west to the lode, and a drive 10 feet north on reef. This lease was forfeited in October, 1896; the lode then passes through the BLUE FLAG, G.M.L. 179. There is a shaft on it towards the south boundary, and a parallel formation about four chains to the eastward. Several shafts have been sunk here on two other reefs. Mr. Angove enumerates six shafts from 62 feet to 26 feet, with 46 feet drives. This formation is an outlying representative of the banded series which appears extensively half-a-mile eastward.

South of this is the TRUE BLUE, G.M.L. 233, which has a cross reef and small shaft on it. There is a vertical shaft near the south boundary on the lode, which Mr. Angove says is 40 feet deep, with a crosscut driven east.

South of this was the AGNES VENTURE NORTH, G.M.L. 781; this and G.M.L. 782 were held by the Norseman, Limited, Syndicate, an English Company. There are two shafts here on the line of the lode, which underlays 60 degrees to west, it was voided in July, 1900.

Next south was the ST. AGNES No. 2 NORTH, G.M.L. 38; which subsequently became the ST. AGNES No. 2 NORTH, G.M.L. 142. Mr. Angove states that in August, 1896, there were three shafts; one vertical 51 feet, with drives south 22 feet and north 25 feet, and two underlay shafts 32 feet and 35 feet. The lease ceased to exist in November, 1899, but subsequently became AGNES

VENTURE, G.M.L. 782, which became void in July, 1902. The north shaft here is on a quartz reef underlying east; it intersects a quartz porphyry dyke; portions of both quartz and dyke show a banded character [**5945**, **5949**]. The next shaft south, about 150 feet, shows graphite schist in the dump. A little farther south-west is Hart's adit on the CALEDONIAN, G.M.L. 885. It is 180 feet long, and was made with the idea of tapping the Valkyrie Reef on the underlay. It has since been abandoned, for it was found that the project was not a sound one. Two crushings have been obtained from this lease, details of which are to be found in the table of returns. About four to six chains southward of the adit there are two shafts on the lode line, where two cross reefs intersect it. The lode then cuts out, and re-appears about seven chains farther south, but about four chains to the east. This is in the KINGSWOOD, G.M.L. 123, upon which there are three shafts on the saddle of the cross ridge. Mr. Angove states that one is 195 feet on the westerly underlay and another 150 feet vertical and 60 feet on underlay, a crosscut connects the two shafts. Mr. Bevilaqua, who formerly held this lease, states that the latter had 50 feet driving, and that a third shaft is 100 feet; he said that a considerable amount of foul air occurred here. The lode is graphitic, with pyriteous quartz. The underlay is 75 degrees to west. The owner expected to be able to cut the St. Agnes Reef.

On the south-west side of the last was the ST. AGNES No. 1 NORTH, G.M.L. 46, which was eventually amalgamated with G.M.Ls. 142, 593. The property became void in November, 1899; subsequently it was known as the MOONLIGHT, G.M.L. 855, and finally as CALEDONIAN, G.M.L. 885, which was surrendered at the close of 1904.

Table showing the Yield of the Agnes Venture Reef.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1896 ...	Kingswood 123 ...	...	10·00	...	...	15·00	Bevilaqua
1897 ...	Do. ...	...	10·00	...	..	5·50	Do.
1897 ...	St. Agnes No. 2 N 142	...	60·50	...	...	55·05	
1903 ...	Q.C. 115 on 142 ...	...	17·00	...	...	11·96	State Battery
1898	St. Agnes No. 1 N.E. 46	...	48·00	...	...	37·40	
1899 ...	Do. ...	...	45·00	...	...	12·00	
1902 ...	Moonlight 855 ...	...	14·00	...	...	5·65	
1903 ..	Q.C. Evans and party	...	38·00	75·00	·26	4·46	State Battery
1903 ...	Q.C. 115 on parts 113 and 782	...	17·00	...	...	11·97	Do.
			259·50	75·00	·26	158·99 ·26	
						159·25 or	·614 ozs. per ton.

Lady Jean Reef.

The north end of this reef appears on the west side of the Great Boulder Norseman, G.M.L. 104, already mentioned at the middle of the line of the last reef, and to which it is nearly parallel, although it underlays to the east. The length of the reef is about 3,000 feet.

The main shaft of the Great Boulder is on this reef, and is probably 120 feet in vertical depth. The dump shows coarsely crystalline amphibolite and actinolite rock [**5655**]. This shaft was put down to intersect the Lady Jean Reef at a depth. A long line of quartz porphyry occurs in the west side of this main shaft. There are then two shafts 50 feet each on the same reef, which is from three to four feet wide, according to Mr. Angove, also an underlay shaft a few chains northward at an outcrop of the same reef.

South of this was the Pekin, G.M.L. 118, on which there is a vertical shaft of 55 feet. The property ceased to exist in August, 1896, and was subsequently retaken up under the name of the Pekin, G.M.L. 577, which, however, only was held until December, 1897.

South again was the Canton, G.M.L. 92. There are two underlay shafts here on the Lady Jean Reef. Mr. Angove states that one is 52 feet, the other 60 feet in depth, and the reef nine inches to 12 inches wide. The lease subsequently became the Canton, G.M.L. 244, from which a small crushing was obtained. Having been forfeited in 1896, it subsequently became the Canton, G.M.L. 576, and, in 1897, in part Lady Jean North, G.M.L. 800.

South of this was the Middleton, G.M.L. 91, owned by G. T. Sinclair, who is stated to have expended £800 on the lease; shafts, one 110 feet deep with 60 feet drives; one 55 feet, and three others 25 feet to 30 feet have been sunk. The Middleton was voided in 1897, and subsequently became the Lady Jean, G.M.L. 757. These three last leases were amalgamated in July, 1900. The old shaft at the south-west corner is 45 feet vertical, and continued for a further distance of 125 feet on an underlay of 25 degrees. There are drives at 60 feet and 150 feet respectively. At 110 feet the oxidized zone begins to change to harder rock, and at bottom the rock is a slightly schistose amphibolite. At the south end of the lower drive the country rock becomes considerably ferruginous. A new shaft towards the centre of the lease is vertical 70 feet, all in soft brown oxidized rock. The reef averages 12 inches. Cross courses of quartz about 1 inch to 2 inches in thickness are met with in both workings; they occurred at a rich patch, but cannot be said to indicate gold. In addition, slickensided faces are numerous, indicating horizontal movement [**5952**], along the plane of the reef. There is also a shaft 50 feet and two shafts 30 feet each. Up to May, 1905, between £4,000 and £5,000 had been expended on the mine.

South-west of 757 was the **Mildura Block Extended**, G.M.L. 235, this, having been surrendered, subsequently became Q.C. 110, which existed as such from July, 1902, to January, 1904.

On the east side of this was the **Norseman Central**, G.M.L. 267. There is a shaft sunk here down to the Lady Jean Reef, which continues south into these last two leases.

The various details connected with the gold yield of the Lady Jean Reef will be found in the table below:—

Table showing the Yield of the Lady Jean Reef.

Year.	Name and No. of lease.	Ozs. dollied.	Tons. crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1899 ...	Canton, 244 ...	...	6·00	...	..	2·70	
1900 ...	Canton, with 757, *see* below	...	...	...	...	...	
1901 ...	Q.C., Hoffman, Canton	...	6·00	...	...	2·54	State Battery
1902 ...	Do. ...	...	...	4·00	·63	...	Do.
1903 ...	Unregd. Q.C., Evans, 244	..	16·00	12·50	5·71	4·51	Do.
1898 ...	Middleton, 91 ...	...	23·00	...	...	3·75	
1899 ...	Do. ...	...	7·00	...	...	1·35	
1899 ...	Lady Jean, 757 ...	6·00	82·00	...	...	202·17	
1900 ...	Do. ...	...	293·00	...	...	373·93	
1900 ...	Do. ..	...	...	43·50	4·93	.	State Battery
1901 ..	Lady Jean, 757, 800	...	381·00	...	...	508·54	
1901 ...	Do. ...	...	...	275·00	68·10	...	State Battery
1902 ...	Do. ...	...	335·00	..	...	715·97	
1902 ..	Do. ...	...	...	201·50	61·45	...	State Battery
1903 ...	Do. ...	...	260·00	...	...	409·15	
1903 ...	Do. ...	...	...	191·50	44·32		State Battery
1904 ...	Do. ...	...	189·00	...	.	280·88	= 244·44 F. 17·66 Silver
1904 ...	Do. ...	...	...	210·91	59·93	...	State Battery
1904 ...	Q.C., 110 on 235 ...	.	31·00	...	...	11·20	
		6·00	1,629·00	938·91	245·01	2,516·69 245·07 6·00	
						2,767·76	or 1·699 ozs. per ton

The Lone Hand Reef.

Adjacent to the south boundary of the Norseman townsite there are several cross reefs and north and south reefs on which six leases were taken up, but very little is known now concerning the workings. **The Spirit of the West**, G.M.L. 264, had a cross reef, underlying south, on which two shafts have been sunk 50 feet and 60 feet. On the east side of this was the **Lone Hand**, G.M.L. 141. Mr. Angove enumerates five shafts, two 90 feet on westerly underlay on two parallel lodes; one was on a reef 4 feet 6 inches wide, driven on south 30 feet; in the other at 70 feet level there is a drive south 40 feet on a reef 5 feet wide. Another shaft vertical 40 feet, another 40 feet on a reef 2 feet wide, another 40 feet (*see* returns). To the south of this was the **Joker**, G.M.L. 148, on which three shafts have been sunk, but no particulars are obtainable regarding them.

Table showing the Yield of the Lone Hand Reef.

Year.	Name and No. of lease.	Ore crushed.	Yield.
		tons.	ozs.
1897 ...	Lone Hand, 141	150·00	16·50
		or ·11ozs. per ton	

The Star of Erin Reef, etc.

About half a-mile south-easterly from here some quartz porphyry dykes occur, these have been followed by short quartz reefs. Here was the **Midas**, G.M.L. 135, which was held by the Midas G.M. Co., which gave, however, most attention to their other lease the John Bull. Mr. Angove states that Brown's shaft was 65 feet deep (on the Midas reef) underlying south; another 70 feet deep also underlying south, with a drive east for 20 feet on same, with a fair amount of stoping. There is also a smaller north and south reef on the eastern side [**5997**]. Between two of the quartz porphyries occurs an intrusive diorite dyke [**5995**]. The amphibolite forming the country rock has been altered near to it into mica schist [**5996**]. This lease became void in October, 1898, and was subsequently in part Q.C. 30, held by Geo. Graham for a period of four months in 1899, when it became G.G., G.M.L. 743. This latter became void in August, 1900, and was subsequently Q.C. 79, held by the same party until January, 1901; part also of G.G. became Q.C. 80, and was held until January, 1904, about when it became **Star of Erin**, G.M.L. 905. This having been forfeited in July, 1905, was applied for again as **Star of Erin**, G.M.L. 946.

The yield of the Star of Erin Reef is given in detail in the table below :—

Table showing the Yield of the Star of Erin Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1899 ...	Q.C. 30	...	18·00	...	...	13·18	Bevilaqua
1899 ...	G.G., 743	·75	60·00	...	...	20·65	
1900 ...	Do.	...	50·00	...	...	30·90	State Battery
1901 ...	Q.C. 79	...	19·00	...	...	8·03	Do.
1902 ...	Q.C. 80	...	...	30·00	8·03	...	Do.
1903 ...	Do.	...		...	...		
1904	Star of Erin, 905	...	30·50	...	...	13·02	= 11·27 F.
1904	Do.	12·83	...	...	...	...	= 10·83 F.
		13·58	177·50	30·00	8·03	85·78 8·03 13·58	
						107·34 or ·605ozs. per ton.	

The O.K. Reef.

About 15 chains south of the G.G. is the O.K., G.M.L. 903, where there is a shaft 85 feet on the underlay on east and west reef, which dips at 80 degrees south. The reef ranges up to 3 feet in thickness, though the average is about 12 inches. It is a ferruginous quartz, showing gold in places [5998]. To the east and west are the O.K. EAST and O.K. EXTENDED, lately taken up. Half-a-mile south is the commencement of the Mt. Benson group of reefs, which are mostly short, but have proved good producers of gold. They radiate to the north-east, east, south-east, and south-west from the west corner of G.M.L. 43, MT. BENSON as an approximate centre. The northernmost lease on this ground is the ST. VINCENT, G.M.L. 208, which was forfeited in November, 1896.

On its south-east side was the MT. BENSON NORTH, G.M.L. 535, where there is a small north-east and south-west reef, with a shaft on the underlay southerly. The reef skirts the west side of a small quartz porphyry dyke. Having been abandoned in April, 1897, both these leases subsequently became in part MT. BENSON NORTH, G.M.L. 616, and later Q.C. 39, held by W. E. Evans till January, 1904.

The various crushings on the O.K. REEF showed its average to be about 1oz. per ton. The details are to be found in the table below:—

Table showing the yield of the O.K. Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1904 ...	O.K. 903	...	221·00	...	...	215·47	189·61 F
	Do.	...	...	150·66	42·85	...	State Battery
1904 ...	Unregistered Q G., R Peake	...	6·50	...	...	2·15	=1·77 F
1896 ...	Mt. Benson N., 535	...	19·50	...	...	21·75	Bevilaqua
1897 ...	Do.	...	...	...	...	...	
1898 ...	Do.	...	15·50	...	...	8·20	State Battery
1899 ...	Q.C. 39	...	...	...	...	...	
		...	262·50	150·66	42·85	247·57 42·85	
						290·42	or 1·104 ozs. per ton.

The Oversight Reef.

South of the Q.C. 39 was the NORTH BENSON, G.M.L. 62, which subsequently became the MT. BENSON No. 1 NORTH, G.M.L. 565, having been forfeited in September, 1898. A quartz claim, Q.C. 9, held by Geo. Graham, was taken up and a small crushing put through, as may be seen in the return, subsequently this became in part the OVERSIGHT, G.M.L. 914. A vertical shaft has been sunk 93 feet near the middle of the lease on what is apparently the continuation of the Discovery Reef. The reef is much intermixed with the amphibolite country rock, so much so that pyritous amphibolite in parts alone represents the reef, but this has been crushed with the quartz, as it carries fair gold.

Table showing the Yield of the Oversight Reef.

Year.	Name and No. of lease.	Ore.		From cyanide.	From ore.
		Crushed.	Cyanided.		
		tons.	tons.	ozs.	ozs.
1898 ...	Q.C. 9 (Graham) on 565 ...	15·50	...	...	8·23
1904 ...	Oversight, 914	28·00	...	...	74·95 (or 66·71F)
		...	14·00	12·45	...
		43·50	14·00	12·45	83·18 12·45
					95 63 or 2·198ozs. per ton

The Cumberland Reef.

Ten chains south-east of the Oversight was the east end of Hall's Reef, on which was situated the JOHN BULL, G.M.L. 53, held by the Midas G.M. Co. There were in June, 1900, five shafts, 140 feet, 100 feet, 85 feet, 60 feet, and 50 feet deep respectively, with 500 feet of driving and 100 fathoms of stoping. The lease was amalgamated with the Mt. Benson G.M. Co. in April of 1903.

On the west of the John Bull was the Mt. Benson G.M. Co.'s leases, MT. BENSON, G.M.L., 43 occupying the west end of Johnson's Reef and the John Bull Reef, which joins it. The MT. BENSON EXTENDED, G.M.L. 42, which has the western portion of Hall's Reef and the Discovery Reef and the MT. BENSON WEST, G.M.L. 816, these were amalgamated in the early part of 1901. The Mt. Benson West became subsequently the Evening Star, G.M.L. 889. The Company stated in February, 1902, that in G.M.L. 43 they had sunk six shafts, 140 feet, 115 feet, 85 feet, two 60 feet, 50 feet deep respectively, with 923 feet drives and 81 feet crosscuts; in G.M.L. 42, six shafts, of 120 feet, 110 feet, 100 feet, 350 feet respectively, with 751 feet driving and 30 feet crosscuts. In lease 816, five shafts, two 60 feet deep, one 50 feet deep, and two 30 feet deep. In lease 53, five shafts, 205 feet, 120 feet, 90 feet, 25 feet, 20 feet deep, with 167 feet drives, and 111 feet crosscuts. In March, 1903, this Company was amalgamated with the Cumberland G.M. Co. whose properties adjoined them on the south side, holding G.M.Ls. 579, 690, in which was the Cumberland main reef and G.M.L. 700. The last one was, however, abandoned. The Company's ground then comprised G.M.Ls. 42, 43, 898, 889, and 53, having a total of a little over 86 acres. The Cumberland Co. stated in December, 1902, they had crushed 4,398 tons of stone yielding 4,230 ozs., which at the average value per oz. for that year of £3 11s. 6¼d. equals £15,126 (Fig. 15). The work done at the time of amalgamation in G.M.L. 681 comprised two shafts 80 feet and one 30 feet deep, with 167 feet of driving in addition to 111 feet crosscuts. In G.M.L. 816 there were two shafts 60 feet, one 50 feet, and two 30 feet deep with 55 feet driving.

In the present Cumberland Gold Mine only one reef, Hall's Reef, was being worked at the time of my inspection, viz., that in G.M.L. 42, Mt. Benson Extended. It has approximately an east-north-east course underlying 70 degrees to south. The new main shaft is here 350 feet vertical depth, with levels at 150 feet, 250 feet and 350 feet; very little stoping has as yet been done.

The lower level had been driven 167 feet east [5981] and 137 feet west [5982]; the upper was 332 feet east [5983] and 148 feet west. It has since then been connected with the Monday shaft workings for ventilation purposes. The reef has an average width of about two feet six inches in the upper levels. The walls are very well defined and regular; the quartz has a bluish colour and frequently has numerous inclusions of a formation or gossan. The gold is very fine and the ore is free milling. The old workings on this reef are to the eastward and comprise two underlay shafts and a drive at about 60 feet. About 50 feet from the easterly boundary another reef, the John Bull, meets this reef in a south-south-east direction underlaying 75 degrees to the north and they unite. The John Bull Reef has been driven on for a short distance to the west and also eastward to the 80 feet vertical shaft at the quartz porphyry dyke. This shaft is known as the John Bull or Bickford shaft. The reef is about 18 inches in thickness average, but narrows greatly on passing into the dyke which underlays 60 degrees to west.

In the next lease south of this is Johnson's Reef, it has a more south-easterly course and extends into the Avon, G.M.L. 898. The reef has a southerly underlay of about 70 degrees and has been worked from the western end by an adit 420 feet long with underlay shafts; it probably averages two feet wide. The formation is larger than in Hall's reef. In the upper portion this is represented by a

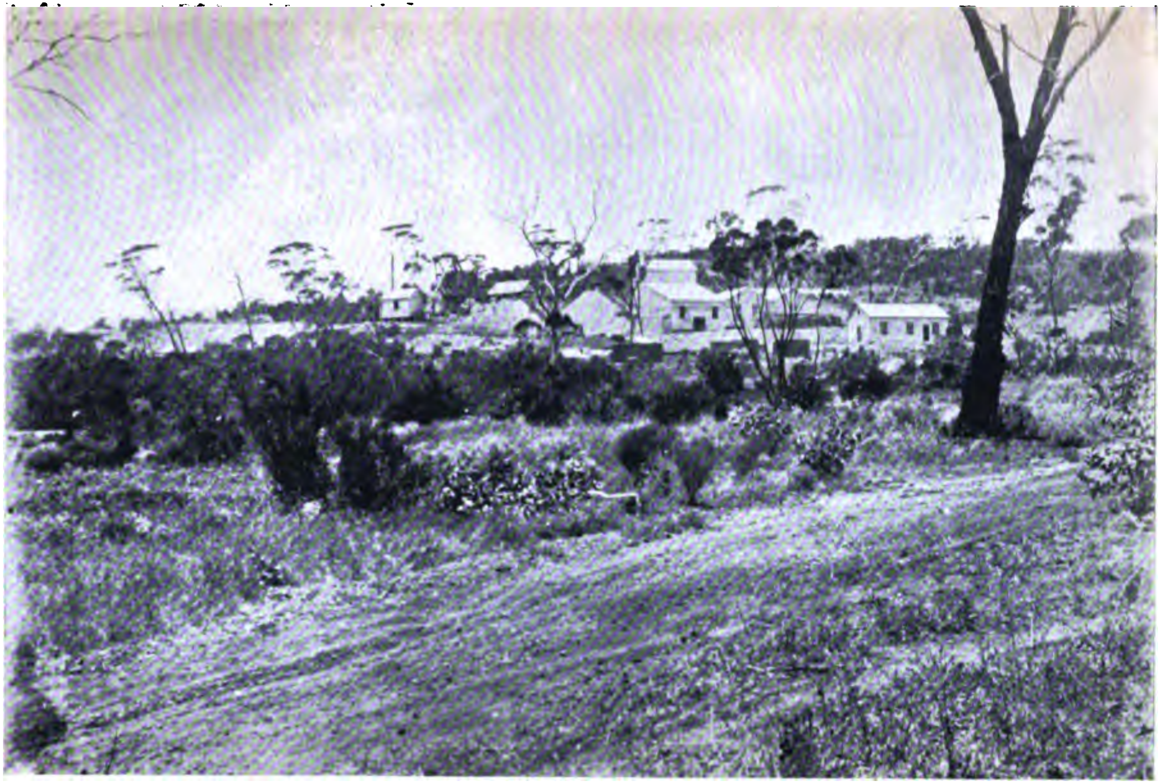


Photo., W. D. CAMPBELL. Govt. Photo. Litho.

Cumberland, G.M.L. 42, Mt. Benson North, looking south-east.

clay in which the then manager states that "slugs" of gold were embedded; it is stoped from the adit level to the surface.

The eastern continuation of Johnson's reef was in the Mt. Benson No. 1 Extended, G.M.L. 52. In April, 1899, this lease was merged into the Kirkpatrick Mt. Benson G.M. Company, which, then, also held the Rising Sun, G.M.L. 71, and the Kirkpatrick Mt. Benson, G.M.L. 614. In November, 1901, the Company stated that in lease 82 they had sunk five shafts, two of 140 feet, 120 feet, 60 feet, and 30 feet, and also 670 feet of drives and 222 square yards of stoping. I was informed that the main shaft towards the eastern end of 52 lease is 160 feet vertical depth. Lease 52 became void in July, 1903; the northern portion became the Avon, G.M.L. 898, and is held by the Cumberland G.M. Company.

Monday shaft is on the southerly sweep of Hall's reef. The reef is here very variable, averaging about nine inches wide, but is rich in places; on the south side of the shaft it bifurcates. The eastern branch is highly pyriteous. The quartz porphyry dyke adjacent to the shaft is also highly pyriteous and underlays to the west; it was apparently met with in the Cumberland West shaft at 90 feet, thus showing an underlay of about 32 degrees.

The Discovery Reef is about seven chains north of Hall's reef. There is here a vertical shaft about 100 feet with drives east and west on an 18 inch reef at bottom, which carries fair values. This reef is evidently identical with that in the Oversight lease already referred to.

The Cumberland Main Reef trends north-east and south-west across the western summit of the hill in G.M.L. 579, the Cumberland; it underlays 70 to 80 degrees to the west and outcrops on the west side of a quartz porphyry dyke having the same direction. A special feature of this reef is the occurrence of cross spurs of quartz; these are curved about greatly. A schistose formation or gossan occurs on either side of the reef carrying calcite and pyrites ([**5978**] assays 10 grains per ton). The chutes of ore dip south, and the reef makes and pinches greatly from 6 inches to 6 feet in thickness.

The reef has been traced across the Southern lease 690, the Waipukerau, which was previously in part the New Zealand, G.M.L. 58, where Mr. Angove states it was 1 foot 6 inches to 3 feet thick, carrying good values. The main shaft is vertical, about 15 chains south of the Monday shaft, and is 227 feet deep, with levels at 73 feet, 185 feet, and 217 feet respectively, and an adit level. Considerable sized bunches of iridescent iron pyrites occur in the lowest level, and are said to carry gold in places [**5977**]. The workings of this mine are shown on Plate III.

There are also workings on the ends of the east and west Kirkpatrick reefs, which extend easterly into this lease.

The following table gives the yield of the group of reefs described above:—

Table showing the Yield of the Cumberland Reefs.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1896 ...	Cumberland G.M., 579	...	160·00	...	...	216·00	
1897 ...	Do. ...	...	210·00	...	...	157·58	
1898 ...	Cumberland G.M., 579, 690	...	420·10	...	...	1,520·50	
1899 ...	Cumberland G.M., 579, 690, 700	...	568·00	...	...	524·73	
1900 ...	Do. ...						
1901 ...	Do. ...	...	1,004·00	...	...	1,053·15	
1902 ...	Do. ...	...	733·00	...	...	687·96	
1903 ...	Cumberland G.M., 42, 43, 53, 579, 690	...	·05	1,100·00	580·48	3·83	
1904 ...	Cumberland G.M., 42, 43, 53, 379, 690, 889, 898	...	4,324·00	...	...	6,356·42	=5,724·46 F.
			7,419·15	**1,100·00**	**580·48**	**10,520·17** 580·48	
						11,100·65	or 1·496ozs. per ton.
1896 ...	Mt. Benson G.M., 42, 43	...	1·50	...	...	19·00	
1897 ...	Do. ...	...	610·90	...	...	527·17	
1898 ...	Mt. Benson G.M., 42, 43, 681	...	1,867·00	...	...	1,459·30	
1899 ...	Do. ...	...	972·00	...	...	1,362·70	
1900 ...	Do. ...	...	930·00	...	...	914·56	
1901 ...	Do. ...	...	132·00	...	...	252·80	
1902 ...	Do. ...	...	184·00	...	...	187·05	
			4,697·40	...	...	**4,722·58**	or 1·0057ozs. per ton.
1898 ...	John Bull Midas G.M. Co., 53	...	314·00	...	..	315·15	
1899 ...	Do. ...	...	366·00	...	...	206·24	
1900 ...	Do. ...	...	50·00	...	...	30·90	
			730·00	...	...	**552·29**	or ·7565ozs. per ton.

The Excelsior and Eureka Reefs.

The EUREKA, G.M.L. 728, south of the Mt. Benson North, has two shafts near its eastern boundary upon what may be a continuation of the Discovery reef.

South of the Eureka was the MT. BENSON WEST, G.M.L. 259. This lease occupied portion of the same ground as G.M.L. 816 of the same name already referred to among the Mt. Benson G.M. Co.'s leases. Mr. Angove mentions three shafts, one 45 feet on the underlay of the reef, with a drive south 8 feet; another shaft 40 feet, vertical; and a third 35ft., in progress in 1896.

South of this was the Cumberland West, G.M.L. 897, on existing lease, and Cumberland West Extended, G.M.L. 927, which are both situated on the west side of G.M.L. 579. In the former there is a shaft on the underlay east of a reef, which is parallel to the Cumberland main reef. Mr. Angove states that this is 40 feet deep, and the reef 4 feet wide, carrying gold at surface. This ground was then Excelsora Magna, G.M.L. 275, where Mr. Angove states there was a shaft 40 feet on the underlay of a 4 feet reef, carrying gold from surface. A new shaft is being sunk at the eastern end to endeavour to find the Cumberland reef on the west side of the quartz porphyry dyke at the west end of that reef. The lease also includes a shaft on its south boundary. This was probably the one Mr. Angove mentions in the then Alice, G.M.L. 354, as being 30 feet vertical, with a crosscut 40 feet west, but no reef was found. The dump shows fine grained pyritous amphibolite [5994].

The yield from these two reefs as shown in the table below is small.

Table showing the Yield of the Excelsior and Eureka Reefs.

Year.	Name and No. of lease.	Tons treated.	Tons cyanided.	Ozs. from cyanide.	Ozs. therefrom.	—
Previous to 1897	Excelsora Magna, 275	20·00	...	...	4·00	
1902 ...	Eureka, 728 ...	10·00	9·00	1·08	2·53	State battery
		30·00	**9·00**	**1·08**	6·53 1·08	
					7·61	or ·254oz. per ton

The Recoupe Reefs.

On the south side of the Cumberland Company's ground were the Recoupe Reefs. These are two or more short reefs underlaying south and approximately parallel with the Kirkpatrick reefs, which will be described next. The Three Stars, G.M.L. 220, was here. The main shaft was in the northern, the principal reef. The lease was forfeited in March, 1897. It was in part subsequently the Recoupe, G.M.L. 681, from which two small crushings have been recorded. The Recoupe was surrendered in April, 1904. It eventually became the Recovery, G.M.L. 913, from which another small crushing was recorded in 1904.

One of the Recoupe reefs runs into the next lease west, the Athelstone, G.M.L. 325. There is a shaft on it, probably the 30-foot shaft mentioned by Mr. Angove, on a reef one foot wide at surface, but which cut out at the bottom of the shaft. Another shaft about 150 feet north-west appears to be on the main reef. It had been carried down 57 feet on the underlay. There was also a drive north on reef, and a crosscut 55 feet. The material in the dump shows a little copper ore. At the south end of this lease there is another parallel reef with a shaft upon it. It goes into the next lease eastward, the HOPE, G.M.L. 252, where, according to Mr. Angove's account, there are three shafts. No. 1 is 39 feet on small leaders. No. 2 is 40 feet on reef 20 inches wide. No. 3 is 30 feet on easterly underlay, with a drive on the bottom on reef one foot wide. There are no crushing returns from these leases. On the east side of the Hope was the AURARIA, G.M.L. 357. Mr. Angove mentions two reefs, one 18 inches, of poor quality, and one 2 feet 6 inches on which there were two underlay shafts 41 feet and 40 feet. There appears to have been no work done since, and there do not appear to have been any crushing returns.

The table attached gives the yield of the Recoupe Reefs:—

Table showing the Yield of the Recoupe Reefs.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
Previous to 1897	Three Stars, Mt. Benson, No. 2 Extended, 220, 257	...	20·00	...	...	24·00	
1897 ...	Do.	...	36·00	...	...	14·00	Revilaqua.
1897 ...	Recoupe, 681	...	30·00	...	...	16·50	
1898 ...	Do.	...	70·00	...	...	33·55	
Note.—1899 to 1902, *see* 42 and 43.							
1903 ...	Recoupe, 681	...	150·00	...	...	323·95	
1904 ...	Do.	...	...	69·00	36·08	...	State Battery
1904 ...	Do.	8·23	...	...	...	...	=6·30 F.
1904 ...	Unregistered Q.C., Rogers	...	19·00	...	...	13·80	State Battery
1904 ...	Do.	...	...	15·49	32·08	...	State battery.
1904 ...	Recovery, 913	31·68	...	...	...	...	24·23 F.
		39·91	325·00	84·49	68·16	425·80 68·16 39·91	
						533·87 or 1·643 ozs. per ton.	

The Kirkpatrick Reefs.

The KIRKPATRICK REEFS are two east and west reefs on the east side of the Cumberland G.M. They are each about 800 feet in length, and underlay south about 35 degrees, and, moreover, have been tested to a depth of about 130 feet. They are small, but have rich pockets of ore. Slickensides are frequent in the walls of the reefs, whilst the quartz is more ferruginous than usual in the district. The reefs were occupied by the RISING SUN, G.M.L. 71, and the KIRKPATRICK MT. BENSON, G.M.L. 614. On lease 71, the Company stated that in 1901 there were four shafts, 160 feet, 134 feet, 60 feet, and 30 feet deep respectively, and 641 feet of drives, in addition to 3,982 sq. yards stoping, and had crushed 895 tons of stone for 988ozs. A double row of quartz porphyry dykes traverses these leases in a north-easterly direction; the eastern one is either accompanied by a porphyry vein or it changes into [5985] porphyry similar to that occurring in the Norseman No. 1 North. The vertical shaft at the north-east corner of G.M.L. 71 is 168 feet deep. The crosscuts east and west at the bottom show one quartz porphyry dyke to west of the shaft, and two on the eastern side. These dykes are pyritous, and also slightly auriferous [5986, 5987, 6120, 6121].

These leases became void in July, 1903, and became in part Q.C. 147, and held by Messrs. Graham and Marquand from September, 1903, to October, 1904; Q.C. held by Baker and Wooding from September, 1903, to October, 1904; Q.C. 165, TIPPERARY, held by D. E. Smith from June, 1904; and Q.C. 167, held by Messrs. Graham and Marquand, from October, 1904.

The central portion is now embraced by the CUMBERLAND EAST, G.M.L. 896, and also UNREG. Q.C., held by Wooding and party in December, 1904.

The details connected with the various crushings on the Kirkpatrick Reefs are given in tabular form in the return appended:—

Table showing the Yield of the Kirkpatrick Reefs.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1896 ...	Kirkpatrick Mt. Benson, 614	...	100·00	...	...	88·90	Bevilaqua
1898 ...	Do., 52, 71 ...	...	200·00	...	...	297·29	
1899 ...	Kirkpatrick Consolidated, 52, 71, 614	...	296·00	...	...	329·63	
1900 ...	Do.	...	316·50	...	...	282·97	
1901 ...	Do.	...	144·50	...	...	115·53	
1901 ...	Do.	...	...	88·00	23·81	...	State Battery
1902 ...	Do., 52, 71 ...	...	182·00	...	...	139·91	
1902 ...	Do.	...	...	9·00	2·34	...	State Battery
1902 ...	Kirkpatrick Mt. Benson G.M. 614	...	76·00	...	...	29·32	
1902 ...	Rising Sun, 71 ...	13·25	28·50	...	...	124·20	
1903 ...	Do.	31·00	13·00	...	...	12·34	
1904 ...	Q.C. Wooding, 71	...	27·00	...	...	32·60	29·03 State B.
1903 ...	Quartz Claims 147, 153, 165, 167	...	131·50	62·50	19·84	116·46	State Battery
1904 ...	Cumberland East, 896	...	101·00	...	...	111·04	= 100·17 F.
1904 ...	Do., 896 ...	7·58	...	...	...	...	= 5·80 F.
		51·83	1,616·00	159·50	45·99	1,680·19 45·99 51·83	
		...					
						1,778·01	or 1·100ozs. per ton

The Try Again Reef.

On the east side of the Kirkpatrick Mt. Benson was the TRY AGAIN, G.M.L. 159, the reef in which may be a continuation of the Johnson's reef. Mr. Angove mentions three shafts, 60 feet deep, 40 feet and 25 feet on the underlay, the first two are connected at 30-feet level. The width of the reef varies from 15 inches to 2 feet. A small crushing from here yielded ½oz. to the ton, and is included in the returns from the Union Reef.

The Union Reefs.

The Union Reefs are parallel reefs, three and perhaps four in number, having a steep underlay to the north similarly to the John Bull reef, of which they are probably a continuation. The reefs are mostly one foot wide and carry good values, with formation on the walls; they trend south-east. The Union, G.M.L. 114, was held by an Adelaide Company. The main shaft is on the footwall side of the main reef, vertical, and carried down to a depth of 129 feet. Mr. Catlin states that at 30-feet level drives go 70 feet north-west and 55 feet south-east, with some stoping; at 75 feet level drives go 50 feet north-west and 20 feet south-east, also a crosscut north-east for 125 feet, communicating with the workings on the next reef, where the principal shaft is 80 feet deep, with drives at 30-feet level, 60 feet west and 50 feet east; also at 70-feet level drives go east 50 feet and west 45 feet. Another shaft 150 feet further west is 70 feet, the bottom being in quartz. The lease became void in October, 1899, and was subsequently in part the Union Jack, G.M.L. 812, which was voided in July, 1903; it subsequently became in part Early Dawn, G.M.L. 888, and having been surrendered in February, 1904, it eventually in part Cumberland Extended, G.M.L. 925. It is now Cumberland Extended, G.M.L. 934. There was also here Q.C. 56, held by A. E. Pike for five months in 1900, and Q.C. 64, held by H. Pike from September, 1900, to January, 1904. The few crushings from the Union Reef are recorded below.

Table showing the Yield of the Union Reefs.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Oz. therefrom.	Oz. from crushings.	Remarks.
1896 ...	Try Again 159 ...	...	31·90	...	...	17·00	Bevilaqua.
1897 ...	Union 114	...	289·00	...	...	207·45	
1898 ..	Do.	...	196·00	...	..	50·35	
1899 ...	Do.	...	334·00	...	...	152·80	
1900 ...	Union Jack 812 ...	...	89·00	...	...	120·97	
1901 ...	Do.	...	276·00	...	...	312·17	
1902 ...	Do.	...	128·00	...	...	114·46	
			1343·90	...	...	975·20	or ·725 ozs. per ton.

The Kadince Reef.

On the east side of the Union was the Kadince, G.M.L. 202, in which there are three or four small east and west reefs underlying south from 70 to 80 degrees. The southernmost one is quartz and ironstone. Mr. Angove states that three shafts here were 40 feet each; the stone is said to yield fair values. The lease was void in December, 1897, but some recent work has been done there, but there do not appear to have been any returns therefrom.

The Wilgena Reef.

Half a-mile due south from CUMBERLAND EAST, G.M.L. 896, there are two reefs on the north foot of the Woolyenyer ridge, strike north-east, underlay south 70 degrees, on which there are three shafts. The width of quartz is about 18 inches, and has a good appearance. This is probably the site of Q.C. WILGENA, from which there was a crushing at the State Battery.

Table showing the Yield of the Wilgena Reef.

Year.	Name and No. of lease.	Ore treated.	Gold therefrom.	Remarks.
		tons.	ozs.	
1897 ...	Q.C. Wilgena	20·00	4·00	State Battery
1898 ...	Do.	6·00	1·30	Do.
	Total	26·00	5·30	or ·204ozs. per ton

The Lucky Shot Reef.

One mile south-westerly from the Cumberland G.M., on the north spur of Mt. Woolyenyer, near a quartz porphyry dyke, there is a large outcrop of white quartz, trending north-east and south-west, underlaying 55 degrees north-west, on which there was a shaft and open cut. This was the site of the LUCKY SHOT, G.M.L. 407. There are two small prospecting shafts about eight chains south-easterly from the other one.

The Virginia Reef.

On the south side was the VIRGINIA, G.M.L. 520, of 12 acres, where there is an east and west reef underlaying south about 70 degrees, on which there are two shafts. Q.C. 10 was here subsequently held by James Birrell; was abandoned in January, 1899.

Table showing the Yield of Virginia Reef.

Year.	Name of lease.	Ore treated.	Gold therefrom.	Remarks.
		tons.	ozs.	
1898 ...	Q.C., 10	8·00	3·94	or ·496ozs. per ton State Battery

The Norse Queen Reef.

Half a mile south-west from here was the NORSE QUEEN, G.M.L. 303, at the 122-Mile Peg on the Esperance to Coolgardie

Road. There is here a north and south reef about three feet wide; only a small trench has been made on it.

The Norseman Empress Reef.

On the east side was the NORSEMAN EMPRESS, G.M.L. 452, in which there is a reef outcropping on the south side of a quartz porphyry dyke. The reef trends north-east and south-west and underlays 75 degrees southerly.

The Mount Kirk Reef.

Southward of this the amphibolite country rock and all the outcrops are hidden by surface accumulations on the flat that extends westerly for a mile and a half to the blown sand ridges bordering the west side of Lake Kirk. The edge of the lake around a small hill there on the telegraph line shows a flat rocky floor which can be seen to be seamed by numerous quartz veins all trending in a north-easterly and south-westerly direction. A few also occur on the similar rocky floor on the west side of the lake with the same direction, but the bulk of the quartz in this part follows four lines of ferruginous and sulphide lodes that appear with banded quartzites, having a bearing slightly west of north. These all underlie to the west from 45 to 75 degrees. The quartz reefs range occasionally up to about 2 feet 6 inches wide and are slightly ferruginous. The quartzites are a few feet wide only on the first three lines, as far westerly as the ITALIA, but the fourth is five or six chains wide, and having resisted denudation, it forms the steep hill, Mt. Kirk, on which the leases 532, NORSEMAN PROPRIETARY AND 562, MT. RUGGED were situated.

All the original leases became extinct by the end of the year 1897. Two were taken up again, the ITALIA, G.M.L. 165, became the ITALIA, 567, and MT. KIRK, G.M.L. 132 became the KIRKPATRICK MT. KIRK, G.M.L. 554. These became extinct in February, 1899, and December, 1897, respectively. Almost all, except the two most westerly leases have had at least two prospecting shafts, mostly sunk on the underlay, but no particulars of the workings have been recerded, and they were inaccessible at the time of the geographical survey. There appears to be only a single crushing recorded from this part, and there are no signs of any ore having been carted away, but I heard that sundry parcels of ore taken from some of the paddocks at the dumps have yielded half ounce to the ton. The great expense of carting appears to have stopped operations.

Table showing the Yield of the Mt. Kirk Reef.

Year.	Name and No. of lease.	Ore treated.	Gold therefrom.	Remarks.
		tons.	ozs.	
1897 ...	Mt. Kirk, 132	5·00	·90	or ·180ozs. per ton Bevilaqua

Returning now to the north end of the next line of reefs, near the north end of the area mapped.

The Eden Park Reef.

Ridges of banded quartzite and ironstone commence near the south side of the norite belt. Half a mile south they form three ridges. The western one contains the EDEN PARK REEF that sweeps round diagonally from the central ridge south-westerly to a north and south course; the northern end underlays easterly 70 degrees, as does also another parallel but more broken vein a few chains westerly. The south end underlays to the west. There were here four leases held by the Eden Park G.M. Co.—EDEN PARK, G.M.L. 133; EDEN PARK No. 1 SOUTH, G.M.L. 134; EDEN PARK SOUTH EXTENDED, G.M.L. 176; and HOWESTAKE, G.M.L. 334—of a total area of a little over 49 acres. In these leases a number of underlay shafts were sunk 100 feet and less with drives. MR. Angove states that the quartz ranged from 2 feet 6 inches to 4 feet in thickness. There are no returns of crushings, and the leases were all void by the end of the year 1898. G.M.L. 133 became in part the WELCOME, G.M.L. 732, and was subsequently Q.C. 120. LAST CHANCE, held by D. C. Nieman, and later the WELCOME, G.M.L. 918. Half a mile south this line of quartzites divides and pinches out towards the valley crossing the range, where the Israelite Bay track is, but re-appears on the south side.

Table showing the Yield of the Eden Park Reef.

Year.	Name and No. of lease.	Ozs. Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Welcome 732 ...	...	46·75	...	...	15·00	Bevilaqua
1899 ...	Do. ...	...	106·00	...	...	97·65	
1900 ..	Do. ...	1·20	12·00	...	...	4·80	State Battery
1903 ..	Q.C. 120	...	21·00	...	...	9·59	Do.
		1·20	185·75	...	...	127·04 1·20	
						128·24	or ·690ozs. per ton

The Queen of the West Reef.

On the middle line of quartzite and ironstone ridge about half a mile south of the Eden Park, was the WHITEMAN, G.M.L. 549, of 24 acres, where a shaft is sunk on the top of the ridge on a small quartz vein. South of this was the MILDURA No. 4, G.M.L. 392, on which a shaft 75 feet deep was made, when water stopped further sinking. The lease subsequently became QUEEN OF THE WEST, G.M.L. 529, and was forfeited in May, and was subsequently QUEEN OF THE WEST NORTH, G.M.L. 628, which was voided in 1899.

Leases 549 and 628 were subsequently LITTLE JIM No. 1 NORTH, G.M.L. 788, and LITTLE JIM, G.M.L. 786. Both, however, were withdrawn in December, 1899. At the south end of the latter several shafts have been sunk 80 feet and less on some quartz leaders at the head of the Queen of the West gully, where some alluvial gold had been found. The banded quartzite divides into two lines about here. South of these shafts was the QUEEN OF THE WEST, G.M.L. 390. The original prospectors, Messrs. Pugsley and Kelly, found a nugget of several hundred ounces of gold, it is said, only eight inches below the surface on the brow of the hill, near the original underlay shaft, where there are two very short east and west ferruginous quartz reefs. This shaft meets a vertical shaft to the south at a depth of about 70 feet, and follows the south underlay of the reef 35 feet beyond, when a north and south quartz vein was met with, but then so much salt water came in as to stop operations. The workings were inaccessible, but I am informed that at 55 feet a drive goes east 10 feet and west 45 feet; at both ends the quartz cuts out in quartzite crossing it. The reef was one foot wide, pinching out in places, and carrying rich gold. Another shaft about one and a half chains north of this was put down 76 feet. At 50-feet level a crosscut was taken west for 96 feet to ironstone. At 76 feet a crosscut was put it east for 112 feet, cutting a north and south reef, two feet wide of poor value. The lease ceased to exist in 1900; portions of the north end were subsequently held as Q.C. 82 and Q.C. 83 by Messrs Casey and Dobbie up to January, 1904.

Full details of such of the crushings from the Queen of the West Reef as have been recorded are given below.

Table showing the Yield of the Queen of the West Reefs.

Year.	Name and No. of lease.	Ozs. Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Mildura, 391 ...	...	20·00	...	...	16·50	Bevilaqua
1898 ...	Queen of the West, 390	...	119·00	...	...	255·38	
1899 ...	Queen of the West, 390	2·00	...	...	...	...	
1899 ...	Little Jim, 796 ...	16·56	...	...	...	...	
		18·56	139·00	...	...	271·88 18·56	
						290·44	or 2·089 ozs. per ton.

The Mary Cater Reef.

On the east line of banded quartzites and ironstones was the MARY CATER, G.M.L. 402. Mr. Angove states that a shaft was sunk 30 feet and a crosscut made 25 feet west to banded ironstone, and then 8 feet on underlay. This is probably the shaft on the hillside about 200 feet north of the gully. The well is an underlay shaft, 157 feet deep, near the gully; it yielded at first 250 gallons per hour but has lessened since; the water has been used for stock for many years; an analysis of this is given in Table 1. Another shaft near the north boundary is 22 feet. It was declared that 500 feet sinking and 270 feet driving was done on this and the adjacent leases at an expenditure of £1,500, but there are no returns from the property. The lease subsequently became in part W.R. 160, owned by the Princess Royal G.M. and Mr. R. Pack.

Some alluvial gold has been found in the gully here. South of the original lease a larger gully runs south, in which there has been a large amount of alluvial working; the depth of ground in places was deep enough for driving headings. Where the valley flat begins the silicification of the sandstones has stopped, but their line can be traced for three-quarters of a mile southwards [**5614, 5584**]. The two gullies between this and the Queen of the West gully have also been auriferous. Several shafts have been sunk on the edge of the flat here, 25 feet or more deep, to try for a deeper bottom, but have penetrated decomposed metamorphic sandstone all the way.

The Mildura Reef.

To the south of the Queen of the West was the MILDURA, G.M.L. 391. An underlay shaft has been sunk 35 feet on a north and south reef, about four feet wide, according to Mr. Angove, which it is said showed fair prospects, but the great influx of salt water stopped operations and it was forfeited in 1896. *See* return.

The Bon Accord Reef.

South of this two lines of banded quartzite and ironstone are to be seen at intervals, covered also in places by ironstone conglomerate. The leases that have been here do not require any special notice until the BON ACCORD REEF is reached; it is an east and west reef, underlaying steeply south.

The BON ACCORD, G.M.L. 95, was here, and a considerable amount of work has been done. This lease was void in May, 1897; it was subsequently BON ACCORD, G.M.L. 623, held by the Bon Accord G.M. Co. It was forfeited in November, 1898; subsequently Q.Cs. 18 and 19, held by Veal and Williams, were taken up on it and held until January, 1899, when the ground was embraced by the BON ACCORD, G.M.L. 730, which was renumbered BON ACCORD, G.M.L. 734. A shaft has been sunk 180 feet on the south underlay of a short east and west reef, which is here five feet wide, with a drive at 100-feet level west to the banded quartzite. Either the reef thins out or else the main body has been missed. Also a shaft 50 feet within a couple of chains to the west, with drives of 25 feet and 30 feet east and west. An open cut has been made near the top of the ridge, also a shaft 40 feet with a dr

40 feet east. Subsequently an unregistered Q.C., held by J. Smith, was taken up at end of the year 1904. On the east side was the GOLDEN GULLY, G.M.L. 328.

The Bon Accord reef, as may be seen by a reference to the table below, which gives such details as are available, has returned a little over an ounce to the ton:—

Table showing the Yield of the Bon Accord Reef.

Year.	Name and No. of lease.	Dollied. ozs.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1898 ...	Q.C. 18	...	1·10	...	...	18·22	
1898 ...	Q.C. 19	5·60	...	...	...	...	
1899 ...	Bon Accord, 730 ..	...	37·75	...	...	57·13	
1899	Do. 734...	...	134·00	...	..	108·90	
		5·60	172·85	...	...	184·25 5·60	
						189·58	or 1·098ozs. per ton.

The Belmont Reef.

There have been alluvial gold workings in the gully north of these leases and also in the one south of it. South of the above lease was No. 1 SOUTH BON ACCORD, G.M.L. 125, which was forfeited in May, 1897, and subsequently became BON ACCORD SOUTH, G.M.L. 624, held by the Bon Accord G.M. Co., who sank several shafts; but no particulars are available regarding them.

South of this was the MOUNT ACCORD, G.M.L. 439, which eventually became the BELMONT, G.M.L. 789. There is scarcely any distinguishable reef at the surface, but two vertical shafts were sunk on the ridge. Q.C. 163, held by Christians and party in 1904, embraced part of the lease. The following figures give the details regarding the yield of the Belmont Reef:—

Table showing the Yield of the Belmont Reef.

Year.	Name and No. of lease.	Dollied ozs.	Ore treated.	Gold therefrom.	—
1899 ...	Belmont, 789 ...	...	6·00	60·00	
1900 ...	Do. ...	20·77	18·50	62·80	
1904 ...	Q.C. 163	25·63	...	...	= 21·59 F.
		46·40	24·50	122·80 46·40	
				169·20	or 8·694ozs. per ton.

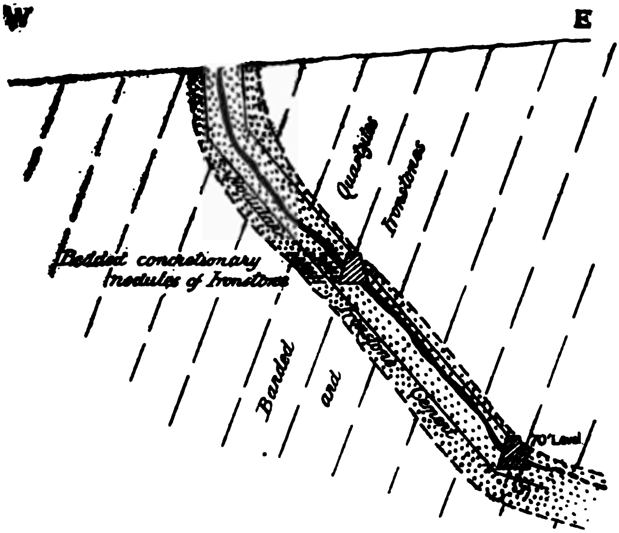
The Albany Reef.

All the gullies running easterly from the Bon Accord to the Narracoorte Gully have been worked by alluvial miners, showing that there must be a considerable amount of gold distributed throughout the lines of banded quartzites and ironstones. On the ridge about 10 chains south-west of the Belmont was the ALBANY, G.M.L. 105, of 12 acres, in which Mr. Angove states an adit was driven 95 feet into the east face of the hill, and a shaft near by was also sunk on its underlay 30 feet. The reef is three feet wide.

The Welcome Reef.

Half a mile south was the WELCOME, G.M.L. 403. There is a reef here 20 inches wide, it underlays east. A few shallow pits were sunk on it, 24 feet, 12 feet, and 8 feet, according to Mr. Angove. It became void in November, 1898, and subsequently Q.C. 158, held by Messrs. Fitzgerald and Hans from a short period in 1904, when it became QUEEN ALEXANDRA, G.M.L. 923. Two shafts were sunk about 70 feet each on this reef. The original ferruginous formation has been converted into a tough ironstone nodules cement at 30 feet depth; the influx of surface water has been sufficient to form saturation zones, causing the cement to form into horizontally bedded nodules. This is shown in accompanying sketch:—

FIG. 16.



CROSS SECTION OF SHAFT AT THE QUEEN ALEXANDRA G.M.L. 923.

The details regarding the yield of the Welcome Reef are given in full in the table below:—

Table showing the Yield of the Welcome Reef.

Year	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanidod.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Welcome, 403 ...	...	46·75	...	...	15·00	State Battery
1898 ...	Do.	35·00	...	...	...	...	
1904 ...	Q.C. 159	...	5·50	...	...	5·91	= 4·86 F.
1904 ...	Do.	...	...	4·00	·64	...	State Battery
1904 ...	Queen Alexandra, 923	...	8·50	...	...	19·10	= 15·73 F.
	Do.	...	...	6·00	2·96	...	State Battery
		35·00	60·75	10·00	3·60	30·01 3·60 35 00	
						68·61 or 1·129 ozs. per ton.	

The La Mascotte Reef.

The Eden Park line of banded quartzite and ironstone reappears on the south side of the Israelite Bay track, where La Mascotte, G.M.L. 441, was situated. A shaft was sunk 45 feet on a reef here with a crosscut 35 feet east, according to Mr. Angove, and which I was told showed good prospects. It was forfeited in 1896.

The Norseman Star Reef.

In the next lease southerly, the Norseman Star North, G.M.L. 398, the same reef probably outcrops on the ridge, where there is a shaft sunk on some good-looking quartz [5903], which is also said to have shown fair values. South of this again was the Norseman Star, G.M.L. 397, where there is another reef, underlaying east, on which there are two shafts; there is a shaft also at the north end of the lease, the dump of which is wholly composed of ferruginous kaolin. South of this again is the Norseman Star South, G.M.L. 445, which has a shaft on the westerly underlay of a vein of which there are no particulars obtainable.

The Wheel Reef.

The next few old leases appear not to require any special comment until the New Chum, G.M.L. 73, is reached, in which Mr. Angove states there was, in 1896, a vertical shaft 40 feet. This is apparently on the Wheel Reef, which extends for 1,000 feet through several leases southerly, underlaying west with the metamorphic sandstone and quartzite. The lease was forfeited in 1897, and was subsequently New Chum, G.M.L. 639; later it became in part Wheel North, G.M.L. 823. The next lease southerly was the Florence, G.M.L. 122, of 12 acres. Mr. Angove states that an underlay shaft was sunk 80 feet on the above-mentioned reef, and that it was 8 feet wide; and also a vertical shaft of 34 feet. Subsequently the Florence became in part the Wheel, G.M.L. 822, when a good deal of work was done along this reef. Q.C. 135, which has been held by Daniels and party since July, 1903, also unregistered Q.C., held by Phillips and party in December, 1904, occupied portions of this ground.

Such details as are obtainable as to the yield of the Wheel Reef are given below in tabular form:—

Table showing the Yield of the Wheel Reef.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1898 ...	New Chum, 639 ...	...	9·75	...	...	1·00	Bevilaqua
1899 ...	Do.	...	6·00	...	...	1·70	
1901 ...	Wheel North, 823	...	5·00	...	...	1·37	
1900 ...	Wheel, 822 ...	...	5·00	...	...	17·88	
1901 ...	Do.	...	61·00	...	...	70·10	
1902 ...	Do.	...	7·00	...	...	4·68	
1902 ...	Do.	...	...	4·00	·56	...	State Battery
1903 ...	Unregistered Q.C., Downey	...	16·00	...	...	1·90	Do.
1903 ...	Q.C., 135	...	44·50	...	...	12·93	Do.
1903 ..	Unregistered Q.C., McNeil	...	...	7·00	·96	...	Do.
1904 ...	Unregistered Q.C., Phillips	...	16·50	9·00	1·77	11·92	= 10·52 F.
1904 ...	Do.	5·95	...	...	...	...	= 4·56 F.
		5·95	170·75	20·00	3·29	113·48 3·29 5·95	
						122·72	or ·718 ozs. per ton.

The United Miners' Reef.

Half a-mile south of this was the Daisy, G.M.L. 79, which subsequently became the United Miners, G.M.L. 127, but locally known as the Erl King. An adit has been driven here easterly 196 feet into the banded ironstone, with occasional quartz leaders; also a shaft, which Mr. Angove states is 85 feet on easterly underlay and another 93 feet similar, with a drive 50 feet north and south. The lease became subsequently in part Q.C. 17, held by R. Stevenson, until March, 1899. On the east side of the Daisy the Golden King, G.M.L. 333, had a brief existence, and became in part the Reefton, G.M.L. 833. Part of G.M.L. 333 was subsequently the Norseman Rose, G.M.L. 916.

The details of the United Miners' Reef are given in tabular form below:—

Table showing the Yield of the United Miners' Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	United Miners, 127	...	·50	...	...	·85	
1899 ...	Unregistered Q.C., Faerie	...	24·00	...	...	17·50	Bevalaqua
1900 ...	Do. ...	...	30·00	...	...	17·45	Norseman G.M.
1901 ...	Unregistered Q.C.	...	12·00	...	...	1·90	
		...	66·50	...	...	37·20 or ·559 ozs. per ton.	

The Narracoorte Reef.

South of this is the Narracoorte, G.M.L. 161, which was held by the St. Agnes G.M. Co. There is a shaft 130 feet on the west underlay of a reef in the quartzite and ironstone. Two other shafts on the west side of the lease are down 100 feet on a quartz reef underlaying east at a flat angle. At the end of the year 1898 the company stated that there were 800 feet of drives in the mine. The reef is said to have been 2 feet wide; a drive at the 100-feet level connects the two shafts; there is also a drive south 200 feet; stoping also has been done, but I am not able to say how much. The crushing was evidently done at the St. Agnes Co's. battery, and there is no separate record of the results from this reef. The Narracoorte Gully passes through this lease. Both the watercourse and the flat adjacent to it have been worked by alluvial miners. Occasionally nuggets of several pennyweights were obtained.

The Tarpeena Reef.

South of this was the Tarpeena, G.M.L. 192. A shaft was sunk on the banded ironstone to a depth, according to Mr. Angove, of 70 feet, and a crosscut made 40 feet, with a drive of 30 feet, on a reef which does not outcrop. There are also three other minor shafts. The ground was forfeited in 1897 and then became the Tarpeena, G.M.L. 661, which, having been withdrawn in 1897, subsequently became the Tarpeena, G.M.L. 906, when a new shaft was sunk close to the other on a small cross vein showing on the surface underlaying south, accompanied by an ironstone cement, which latter is probably only an altered ferruginous formation, and the other shaft was filled with mullock from the new one.

The details of the crushings from these reefs are given below :—

Table showing the Yield of the Narracoorte and Tarpeena Reefs.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1900 ...	Narracoorte, 161	...	23·00	...	...	6·65	State Battery
1904 ..	Tarpeena, 906 ...	...	89·50	...	...	66·09	= 57·13 F.
1904 ...	Do. ...	2·20	...	...	...	...	= 1·86 F.
1904 ...	Do. ...	...	...	64·82	30·08	...	State Battery
1904 ...	Two Japs, 910 ...	22·50	...	...	...	...	20·19 F.
1904 ...	Unreg. Q.C., Campbell	6·14	...	...	...	...	= 5·62 F.
		30·84	112·50	64·82	30·08	72·74 30·08 30·84	
						133·66	or 1·1880ozs. per ton.

The Lord Hopetoun Reef.

On the west side of the last line of banded quartzites and ironstone is another line commencing on the flat opposite to the NORSEMAN STAR SOUTH, G.M.L. 445. On this was the GREAT BONANZA, G.M.L. 560, of 12 acres. One shaft was sunk on the east side of the ironstone.

South of this was the MOONLIGHT, G.M.L. 280. A shaft was sunk here on a reef on the west side. The lease was forfeited in November, 1896. It eventually became the MOONLIGHT, G.M.L. 596, which, having been surrendered in May, 1898, gave place in part to W.R. 145.

South again was the LONE STAR, G.M.L. 80, which subsequently became the CALEDONIA, G.M.L. 313. At this period Mr. Angove states that one vertical shaft was sunk in the ironstone 60 feet, with a drive 15 feet on a reef five feet wide. The Caledonia was forfeited at the close of 1896, and subsequently became the GREAT BARRIER G.M.L. 606, which ceased to exist in 1898. G.M.Ls. 596 AND 606 were subsequently the HORSESHOE, G.M.L. 844. The banded quartzite here becomes a double line. South again was the RED, WHITE, AND BLUE, G.M L. 59. The principal shafts were one of 70 feet, with a crosscut 25 feet to lode and another shaft 40 feet on underlay south of a cross reef.

South of this was the MIGNON, G.M.L. 78, which has a shaft 50 feet sunk on a cross reef underlaying south, and a vertical 70-feet shaft near the south-west corner of lease. These two last were subsequently part of the STAR, G.M.L. 835, which was amalgamated with the STAR SOUTH, G.M.L. 843, in October, 1901. The latter was surrendered in March, 1902, and the former was void in April of that year, and became subsequently in part the **VALE NORTH**, G.M.L. 867. Portions of 867 and 835 became subsequently the **AMY CASTLES**, G.M.L. 917. On the west boundary of leases 280 and 835 are outcrops of reef on which some shafts have been sunk, but which do not appear to be auriferous; they may be a northerly continuation of the outlying reef that extends south from the Broomehill, which is described after the St. Alban's reef.

South of this was the **CHRISTMAS GIFT**, G.M.L. 64, of 24 acres. The holders of this lease put in an adit 30 feet easterly into the ironstone, and sank a shaft on the hill 90 feet on a reef 18 inches wide, with an underlay of 65 degrees to west—the reef was said to carry very good gold, this was probably part of the Lord Hopetoun Reef—also another shaft 60 feet on the west side of the lease.

South of this was the **LEVIATHAN SOUTH**, G.M.L. 87, where a shaft was sunk 60 feet on the west side of the lease. This having been forfeited in 1895, subsequently became the **LEVIATHAN SOUTH**, G.M.L. 453, and afterwards, in part, **BRAESIDE**, G.M.L. 854. This latter was surrendered; subsequently a part of it was embraced by Q.C. 149, held by Mr. Mountford. G.M.L. 64 became subsequently in part the **EDINBURGH CASTLE**, G.M.L. 686, held by the new Queensland Norseman G.M. Co. They utilised the previous Christmas Gift shafts and made the main shaft 180 feet; the middle shaft 70 feet, and the north shaft 40 feet. The main shaft had short drives at 50 feet, 80 feet, and 100 feet. The Company had a three-head battery here. The lease was forfeited and subsequently became the **ABSENT MINDED BEGGAR**, G.M.L. 811, but which was withdrawn in 1900, and part was applied for in April as the **LORD HOPETOUN**, G.M.L. 819; subsequently in part Q.C. 70, held by S. McGonnigal up to March, 1901. The Q.C. **BLOWFLY** was here held by Messrs. Taylor and Fowler. The ground was applied for in 1901 as the **LORD HOPETOUN**, G.M.L. 839, and was forfeited in February, 1902. The **LORD HOPETOUN**, G.M.L. 858, was applied for in May, 1902. The mine was then opened up afresh; the main shaft which had been half filled up was being cleared out at the time of my inspection, and stoping at the 80 feet level north of the shaft was in progress, whilst south of the shaft from the 50 feet level the reef has been stoped out to the surface. The remainder of the G.M.L. 819 not occupied by 858, became the **LORD HOPETOUN EXTENDED**, G.M.L. 924. The northern portions of G.M.L. 686 and portion of G.M.L. 78 became Q.C. 71, **THE COMET**, held by T. J. Earle up to March, 1902; this was north of the Lord Hopetoun shaft; it was merged into the Vale, G.M.L. 838. A shaft is here down 180 feet. This subsequently was the **ADMIRAL TOGO**, G.M.L. 919, which later on was in part the **ALMA**, G.M.L. 940, and is still in force (Fig. 17).

Portion of G.M.L. 835 and G.M.L. 843 became the **VALE NORTH**, G.M.L. 867.

Fig. 17.

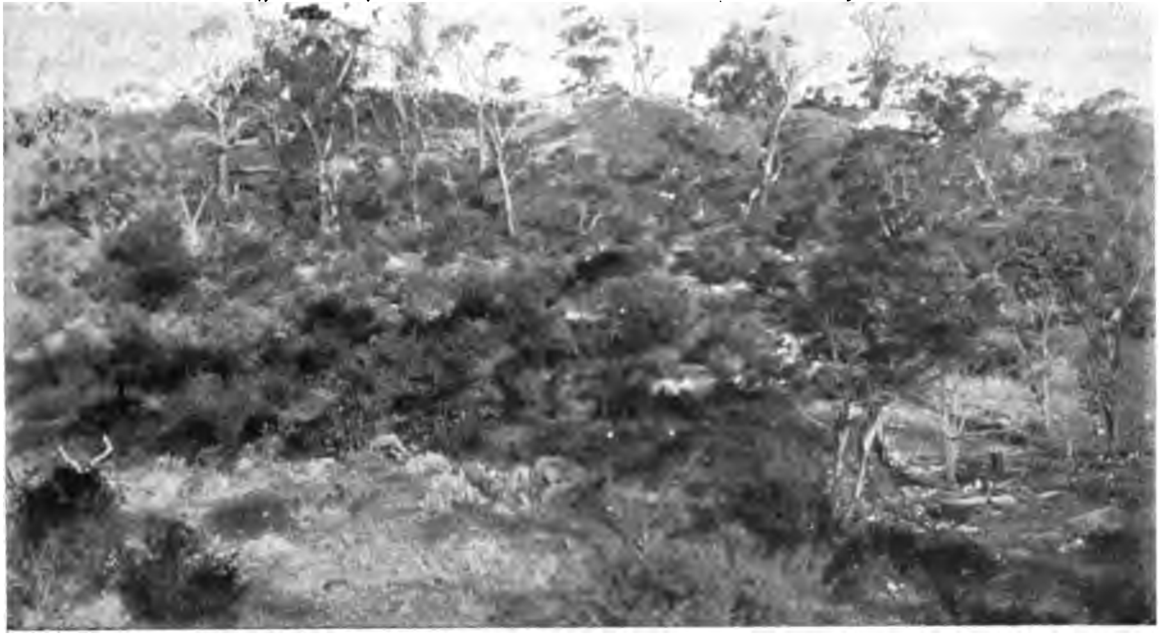


Photo., W. D. Campbell. Govt. Photo. Litho.

Admiral Togo, G.M.L. 919, Norseman, view looking east.

The various details obtainable regarding the Lord Hopetoun Reef are given in tabular form in the return below:—

Table showing the Yield of the Lord Hopetoun Reef.

Year	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1901 ...	Star, 835	...	15·60	...	...	3·23	
1901 ...	Horseshoe, 814 ...	...	31·00	...	...	13·51	State Battery
1902 .	Do. ...	...	10·00	...	...	4·50	
1902	Do. ...	...	...	15·00	4·16	...	Do.
1897 ..	Edinburgh Castle, 686	...	9·50	...	...	6·66	
1898 .	Do. ...	...	55·25	...	...	11·33	
1899 ..	Do. ...	...	46·00	...	...	14·40	Bevilaqua
1899 ..	Do. ...	...	...	58·00	6·37	...	State Battery
1900 ..	Absent Minded Beggar, 811	...	49·50	...	...	42·00	Bevilaqua
1900 ...	Do. ...	...	...	27·00	3·15	...	State Battery
1901	Q.C., Blowfly ...	...	16·00	8·00	1·25	11·82	Do.
1901	Q.C., 71, Comet ...	...	24·00	7·00	1·14	18·46	Do.
1901 .	Vale, 838	...	22·00	...	...	64·08	
1902	Do. ...	...	108·00	...	...	123·42	
1902	Do. ...	...	...	63·50	13·30	...	Do.
1903 .	Do. ...	...	123·00	...	...	97·09	
1903 ..	Do. ...	...	...	54·50	14·23	...	Do.
1900	Q.C., 70	...	37·50	...	..	33·00	Bevilaqua
1900	Q.C., 72	...	7·00	...	...	3·50	State Battery
1901 ..	Lord Hopetoun 819	...	74·00	...	...	42·59	
1901 ..	Lord Hopetoun 839	...	63·00	...	...	35·77	
1902 .	Lord Hopetoun 858	...	47·00	...	...	40·77	
1902	Do. ...	...	...	14·00	1·35	...	State Battery
1903 .	Do. ...	...	160·00	...	...	82·44	
1903 ..	Do. ...	...	...	15·00	1·99	...	State Battery
1904	Do. ...	...	332·00	...	...	233·97	= 208·55 F.
1904 ..	Do. ...	...	...	20·50	4·32	...	State Battery
1904 ...	Lord Hopetoun Leases, 858, 919, 924	...	122·50	...	...	78·85	= 68·18 F.
1904 ..	Do. do.	3·92	...	...	...	...	= 3·22 F.
1902 ..	Braeside, 854 ...	...	36·00	...	...	22·95	
1902	Do. ...	...	...	28·00	4·12	...	State Battery
1903 .	Q.C., 149 on 854 ...	...	17·00	...	...	55·00	Do.
1904 .	Do. ...	...	20·00	...	...	7·65	= 6·47 F., State Battery
1904	Amy Castles, 917	...	24·78	...	...	24·78	= 20·90 F.
		3·92	1,330·08	310·50	55·38	1,071·77 55·38 3·92	
						1,131·07	or ·85ozs. per ton

St. Alban's Reef.

The line of reef outcrops that are along this line of banded quartzites at intervals from south of the Leviathan South to the Narracoorte, a distance of half a mile, is here designated the St. Alban's Reef. It underlays to the east and shows a strong body of stone at the Hit or Miss, where it has been tested to a vertical depth of 100 feet, and also probably to the same depth in the Narracoorte.

On this line of country was the St. Albans, G.M.L., 55. Mr. Angove states that this was the first lease taken up on this line of ironstone country, and that four shafts were sunk, No. 1 vertical 45 feet, with drive north-east, at bottom 35 feet long. No. 2, 30 feet on westerly underlay of a reef 15 inches wide, with ferruginous quartz and ironstone. Nos. 3 and 4, 60 feet each, ditto on a very white quartz reef 2 feet wide. The St. Albans subsequently became Q.C. 154, Golden Bug, held by Messrs. Kirwan and Daniels for two months in 1904, and later Q.C. 160, Golden Bug, held by Steiss and Miller from April to September, 1904. These were on two east and west veins of quartz underlying 35 degrees to south, width 18 inches, both low grade stone. South of this was the St. Albans No. 1 South, G.M.L. 61. Mr. Angove states that the adit which had been driven into the hill easterly 200 feet, gave very good prospects. At 100 feet from the mouth, there is an ironstone formation underlying 70 degrees to west on which there is a short drive. There are also too shafts of 30 feet and 31 feet depth. Part of the ground was subsequently known as the Westralia Long Tunnel, G.M.L. 820, whilst later the Bandit King, G.M.L. 837, occupied portions of it and the United Miners, G.M.L. 127, already mentioned. Subsequently in part it became Q.C. 139 and Q.C. 130 held by Hann and party until December 1903.

On the last line of leases a strong body of quartz was opened up, underlaying east 52 degrees, by two shafts 150 feet each, and another to the north of these 75 feet with drives and stoping. The oxidised rock on the west side of the outcrop has also yielded some good patches of gold [5957]. It subsequently became Unreg. Q.C. held by J. Young, whilst a portion became Q.C. 154, held by Kirwan and party, and eventually they became the Hit or Miss, G.M.L. 863, and were still in force at the time of writing.

The St. Albans Reef crushings are given in detail below :—

Table showing the yield of the St. Alban's Reef.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1900 ...	Westralia Long Tunnel, 820	...	40·00	...	...	6·06	
1901 ...	Do. ...	...	16·00	...	...	5·35	Norseman G.M.
1903 ...	Q.C. 129	24·44	26·00	...	...	6·79	State Battery
1904 ...	Q.C. 154 on 55 ...	...	12·50	...	...	24·44	Do.
1904 ...	Q.C. 160, Golden Bug	...	18·00	...	...	14·51	= 12·07 F.
1904 ..	Do.	21·24	..	...	...		= 19·45 F.
1901 ...	Bandit King, 837	...	91·00	...	...	83·53	
1901 ...	Do. ...	...	...	28·00	6·94	..	State Battery
1902 ...	Do. ...	...	60·00	...	...	34·35	
1902 ...	Unregistered Q.C., Young, on 837	...	56·50	41·50	13·17	48·59	Do.
1902 ...	Hit or Miss, 863 ...	...	21·00	...	..	10·12	
1903 ...	Do. ...	...	...	22·50	5·29	..	Do.
1903 ...	Do. ...	...	31·00	...	...	10·51	
1903 ...	Do. ...	...	...	6·00	1·93	...	Do.
1904 ...	Do. ...	...	12·50	...	...	5·75	= 4·73 F.
1904 ...	Do. ...	...	...	9·00	1·32	...	State Battery
1904 ...	Q.C., Peake, on Mt. Gambier, 384	...	6·50	...	...	2·15	=1·77 F. State Battery
1904 ...	P.A., 47	...	18·50	6·00	·73	8·29	
		45·68	409·50	113·00	29·38	260·44 29·38 45·68	
						335·50	or ·819 ozs. per ton.

The Ziegler's Find and adjacent Lodes.

The line of banded quartzites and ironstone west of the Hit or Miss pinches out suddenly, and for half-a-mile southward is represented only by some narrow patches, but makes again strongly beyond that point, with a large quartz reef near its western margin.

About 15 chains west of the St. Alban's, there is another north and south reef, which has a very broken continuity for upwards of two miles along the western side of the western ridge of the banded quartzites; it underlays west; there are no crushings recorded from it. The depths of the shafts, as obtained from Mr. Angove's report, are as follows:—The northern end appears in the **Broome Hill**, G.M.L. 394, where there are two small shafts 20 feet and 10 feet on the underlay. In the next lease to the south is **St. Alban's West**, G.M.L. 443. It appears as two parallel reefs trending south-easterly, the course being apparently deflected by the presence of a quartz porphyry dyke that occurs to the south of the two principal shafts. In October, 1896, the owners declared that there were four shafts, 106 feet, 55 feet, 27 feet, and 25 feet deep.

Next south is the **Albert Edward**, G.M.L. 331. There were two shafts, one 30 feet on a reef one foot thick, the other 35 feet on a reef four feet wide.

Next south is the **Mt. Gambier**, G.M.L. 384, where the reef outcrops in a huge mass of very white quartz, underlying 55 degree west. A shaft 40 feet has been sunk near its western side, and another 6 chains north-westerly on a small reef.

Next south is the **Blue Ensign**, G.M.L. 372, in which the reef again outcrops. There are two shafts, 50 feet and 10 feet. Mr. Angove states that the reef is 4 feet wide in the former. All these leases were void in December, 1897.

Next south is the **Holstein North**, G.M.L. 510. There are two parallel reefs here to the northward of the Norseman to Government tank road. A shaft has been sunk on the underlay of each reef. The quartz has a dark, clouded-blue tint.

In **Block** 512, about a quarter of a mile farther south, the reef again appears, and four shafts have been sunk on it, but no details are available.

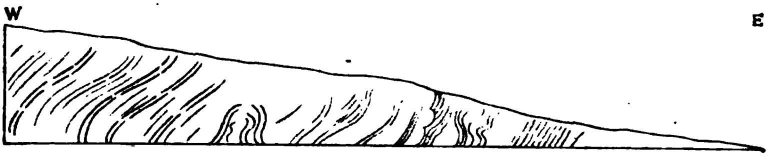
Half-a-mile farther south, several shafts have been sunk on the reef at the south end of the **Lady Bella South**, G.M.L. 766, but no details are available; also in McDonough's Find, G.M.L. 348, occupying the junction of the ridge forming the watershed to north and south with the westernmost of the banded ironstone and quartzite ridges. There appear to be two reefs, at least here, on which shafts have been sunk; one is on the western margin of the banded formation underlying 62 degrees to west.

South of this was the Pirie West, G.M.L. 345, which was forfeited in May, 1896; it was known as the Pine West, G.M.L. 540.

South of this was Holstein No. 1 North, G.M.L. 222. A shaft is here on another outcrop of the same reef, at the south end of this lease.

From here to the W.R.'s 127, 131, 159, at Sawpit Gully, a distance of three-quarters of a mile, there were several leases in which some shafts were sunk on these westerly lying reefs without success. The south-east corner of Block 512, alluded to above, adjoining the New Year's Gift, G.M.L. 406, was void in December, 1897, and subsequently became the Lady Bella North, G.M.L. 765, and Lady Bella, G.M.L. 764. In each of these a shaft was sunk and an adit was commenced; no details are available of the former. The accompanying Fig. 18 shows the convolutions of the ferruginous bands in this formation. Both leases were forfeited in August, 1901. Q.C. 159, was taken up here by O'Leary and Howell in 1904.

Fig. 18.



DECOMPOSED BANDED QUARTZITE AND IRONSTONE. LADY BELLA N° G.M.L. 765.

South of this was the Britannia, G.M.L. 518, which was subsequently in part Lady Bella South, G.M.L. 766. Four shafts were sunk here on the underlay on a reef on the east boundary, also two near the south-west corner, which have been already alluded to. The lease became subsequently in part Ziegler's Find, G.M.L. 907, and is still in force. The workings comprise open cuts and shallow shafts in the eastern slope of the banded ironstone formation, at a saddle between gullies trending north and south, in each of which a little alluvial gold has been found. Here some quartz veins intersect the ironstone horizontally, and are gold-bearing where the ironstone bands are reached; the adjacent rock or its representative ferruginous kaolin being also auriferous [5991]. The shoot of gold has a direction of 225 degrees. A small fault of about two feet runs in a direction of 308 degrees across the workings. On the east side of the next ridge, and north of the sawpit, is a gully where some good alluvial workings have been; the gold has evidently been shed from an auriferous reef in the ironstone ridge. The whereabouts of its source has not yet been found, but the writer was informed that some leaf gold has been found in veins at the head of this gully.

The table appended shows the yield of the reefs alluded to above :—

Table showing the Yield of the Ziegler's Find and adjacent Lodes.

Year.	Name and No. of lease.	Ozs. dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushing.	Remarks.
1899 ...	Lady Bella No. 765	3·45	...	...	...	...	
1900 ...	Do. ...	...	1·00	...	...	1·85	
1899 ...	Do. 764	...	29·00	...	...	300·90	
1900 ...	Do. ...	...	36·50	...	...	9·55	
1904 ...	Ziegler's Find, 907	...	78·00	...	...	354·68	= 334·83 F.
1904 ...	Do. ...	...	...	16·83	22·08	...	= 16·83 F.
1904 ...	Do. ...	35·25	...	...	...	...	= 32·21 F.
1897 ...	Holstein No. 1, 222	...	10·00	...	...	3·50	Bevilaqua
		38·70	154·00	16·83	22·08	670·48 22·08 38·70	
						731·26	or 4·748ozs. per ton

The Oriental Reefs.

On the south side of Sawpit Gully, laterite deposits cover a considerable portion of the ridges. Between the two is Salvado's Gully and its branch Morelli's Gully, where some of the best alluvial workings in the district have been situated. No work was being done on them at the time of this survey. None of the workings seem to have been more than about 10 feet deep; the bottom was, I understand, an ironstone cement. It does not seem quite clear that this has been tested to a greater depth. The very considerable amount of gold obtained here probably had its source in veins, reefs, and the ferruginous bands in the metamorphic sandstones and quartzites, but the present indications do not appear adequate for the returns. There is a ferruginous and auriferous reef on the saddle at the head of Morelli's Gully that has a north and south direction along the west ridge and skirting the quartzite and underlaying west. The north end has been re-opened up by Mr. Ziegler. Possibly further prospecting will disclose richer reefs; if not, then the gold must have been disseminated through the ground that has been denuded in the course of time. The same may be said in regard to the northern watershed of Raggedy Gully adjacent.

Of the leases taken up along this country, the Morrell, G.M.L. 666, was about one-third of a mile south of Sawpit Gully. In October, 1898, it was void; subsequently in part the Trump Card, G.M.L. 768. Two shafts were sunk here on the saddle at the head of Morelli's Gully, on the above-mentioned quartz reef; particulars not obtainable. It was forfeited in 1900, and subsequently became Trump Card, G.M.L. 804, and later on in part the Morrell, G.M.L. 911. At the head of Salvado's Gully was the Oriental-Norseman G.M. Company's blocks, viz., Oriental, G.M.L. 69; Oriental No. 1 North, G.M.L. 70; Oriental Block, G.M.L. 370; and **Oriental No. 1 North Block**, G.M.L. 371, taken up mostly in 1894, having a total of 73 acres. This company made an adit in G.M.L. 69, 420 feet into the ridge westerly to the most solid part of the banded quartzite intersecting a quartz vein and the ironstone lode already referred to; the latter was driven on north. The end of the adit connected with a shaft at the top of the ridge. In G.M.L. 70, an adit 70 feet and a shaft 40 feet were made, and in G.M.L. 371, a shaft was sunk on a small quartz outcrop. These leases became void in 1897, G.M.L. 70 becoming two years later the **Alickazander**, G.M.L. 770, when another shaft and open cuts were made along the cap of the reef and auriferous ironstone along the ridge. The lease was subsequently in part **Lady Millar Extended**, G.M.L. 876, when the ridge workings were extended. About this time a quartz outcrop crossing the south boundary was also opened up, and, it is said, with fair results, as may be seen in the table of returns appended. The lease became an **Unregistered** Q.C., held by Lyons and party, who continued some of the previous open cuts, and obtained a little gold. Since my survey this ground has been taken up by the Lady Mary G.M. Co. as the **Lady Millar**, G.M.L. 928, and is still in force. It includes the southern portion of the lode already referred to. South of the 876 was the **Clarence**, G.M.L. 75, occupying the head of a gully running southerly, where this line of banded formation divides into two lines. An adit 90 feet was driven easterly into the banded ironstone ridge, and a shaft sunk 40 feet. South of this was the **Anchor**, G.M.L. 74, on which two shafts of 40 feet and 18 feet were made, and several open cuts on small reefs. These two leases were subsequently in part the **Oriental South Extended**, G.M.L. 491, and became in part the **Lady Jean**, G.M.L. 748, and subsequently in part the **Lady Mary Extended North**, G.M.L. 795, when two shafts of 35 feet and 50 feet were sunk in the banded ironstone formation. Afterwards it became the **Perseverance**, G.M.L. 866 [**6023**].

The south corner of G.M.L. 491 was subsequently part of the **Lady Mary North Junction**, G.M.L. 718, subsequently the **Lady Mary Extended**, G.M.L. 762. Two shafts were sunk on a reef in the amphibolite forming the valley of the north arm of the Lady Mary Gully. The southernmost shaft is 158 feet on an underlay of 35 degrees, with quartz six inches to three feet thick, and the other shaft about 150 feet distant north-easterly is not so deep, on an underlay of 45 degrees, with quartz six inches to one foot thick; both have drives and stoping. The quartz has very much the appearance of the Lady Mary Reef.

About a quarter of a mile east of G.M.L. 762 was the **Great Eastern**, G.M.L. 448. There is an outcrop of a reef two feet wide having an underlay of 20 degrees northerly. A shaft has been sunk and an open cut made. The country rock is a metamorphosed sandstone.

South of this was the **Lady Mary North Extended**, G.M.L. 359, occupying both the western branch of banded formation and also the next line westerly. Later the lease became part LADY MARY NORTH No. 1, G.M.L. 713, and afterwards the LADY MARY NORTH EXTENDED No. 1, G.M.L. 719; subsequently it became the NEW NORTH MARY, G.M.L. 763. G.M.L. 713 was subsequently the HOSKING, G.M.L. 793, which is the northernmost of the amalgamated leases of the Lady Mary G.M. Such details of the yield of the Oriental reefs as are obtainable are given *in extenso* in the table below :—

Table showing the Yield of the Oriental Reef.

Year.	Name and No. of Lease.	Ozs. Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1897 ...	Morrell 666 ...	77·50	...	...	...	...	
1899 ...	Trump Card 768	...	10·00	...	...	11·55	
1900 ...	Do. ...	...	14·00	...	...	5·25	
1904 ...	Morrell 911 ...	24·01	...	...	...	...	
1898 ...	Unregistered Q.C., Oriental	...	17·25	...	...	45·00	Bevilaqua
1898 ...	Lady Jean (Salvado's) 748	...	52·50	...	...	31·50	
1899 ...	Do. ...	...	22·00	...	...	1·60	
1899 ...	Alickazander 770	...	9·50	...	...	3·33	State Battery
1900 ...	Do. ...	...	502·00	...	...	289·52	
1901 ...	Do. ...	...	214·00	...	...	54·67	
	Do. ...	...	...	57·00	12·46	...	State Battery
1902 ...	Do. ...	22·19	21·00	...	...	8·03	
1903 ...	Lady Millar Extended	...	84·00	...	...	54 70	
1904 ...	Do. ...	...	26·50	...	...	7·04	= 5·80 F.
	Do. ...	...	...	17·00	2·49	...	State Battery
1904 ...	Unregistered Q.C. Lyons on Lady Millar Extended	...	41·00	...	...	22·81	= 19·71 F.
	Do. ...	...	...	9·00	1·22	...	State Battery
1904 ...	Unregistered Q.C. J. Matthews	...	5·00	...	...	7·20	= 6·77 F.
1900 ...	Lady Mary Extended, 762	...	177·00	...	...	86·64	
1901 ...	Do. ...	...	55·00	...	...	18·60	
1902 ...	Do. ...	...	...	...	...	...	
1903 ...	Do. ...	...	25·00	...	...	9·00	
		123·70	1275·75	83·00	16·17	656·44 16·17 123·70	
						796·31	or ·624ozs. per ton

The Stella May.

Raggedy Gully has its source in the Lady Millar lease, after leaving the south side of which it turns east, and at the foot of the main ridge it is joined by the Little Raggedy Gully. A considerable amount of gold has been obtained from both. There are alluvial workings along the course of the gully for a distance of three-quarters of a mile easterly to the line of the easternmost ridge, where the STELLA MAY, G.M.L. 801, was situated. The application for this lease was withdrawn in the early part of 1900, and the ground became subsequently Q.C. 151, held by Geo. Decker, up to February, 1904. Here four or five shafts have been sunk, the main shaft is 100 feet deep, also open cuts made in an altered sandstone, in which some good patches of gold have been found. No reef or lode is discernable; the gold occurs in patches only in the sandstone. The lay of this sandstone is mostly 20 degrees to the north. It has a bluish grey tint mottled with brown; the latter colour predominates, I was told, towards the base of the deposit, which is apparently conformable to and rests on the banded ironstone.

Table showing the Yield of the Stella May Workings.

Year.	Name of Lease and No. of Lease.	Alluvial.	Dollied.	Ore crushed.	Gold therefrom.
		ozs.	ozs.	tons.	ozs.
1900 ...	Stella May, R.C. 6	**141·13**	**9·00**	**58·00**	60·04 9·00
					69·04 or **1·190**ozs. per ton

The Lady Mary Reef.

The LADY MARY REEF is a north and south reef, except at the south end; it underlays east from 45 to 80 degrees; it outcrops and has been worked for a length of 1,500 feet and followed to a depth of 360 feet vertically; it ranges up to six feet thick, with an average of about a foot. At the south end of the north and south reef, a break of about 300 feet occurs, after which it turns westerly, and here rich pockets ofgold have been found (Fig. 19). The reef was discovered by S. W. Pearce, on 29th October, 1894, and a lease of 18 acres (G.M.L. 49) applied for by this prospector's mate, George Prout, on behalf of Geo. Brookman.

The other leases of the Lady Mary G.M. are LADY MARY NORTH, G.M.L. 99, LADY MARY, G.M.L. 49, LADY MARY SOUTH, G.M.L. 864, LADY MARY BLOCK CLAIM NO. 1, G.M.L. 635, LADY MARY BLOCK CLAIM NO. 2, G.M.L. 636, all 12-acre blocks excepting the original one—total 78 acres.

This reef outcrops along the western side of the leases; the older workings for a length of 1,200 feet were worked to a varying depth of about 100 feet during the earlier period of its existence by means of five underlay shafts. These old workings were not readily accessible; portions that I did see, near the small adit, showed two feet to four feet of quartz in the face of the workings. No. 1 shaft is 273 feet on the underlay, but no values were obtained below 100 feet. The main incline shaft No. 7 is the northermost one on this outcrop; it has an underlay of 49 degrees to the first level, and then about 60 degrees to 470 feet, its present depth. The reef varies from two inches to five feet in thickness. A horizontal chute of pay ore occurs in the old workings and extends as far north as the vertical shaft, where another chute about 500 feet in length occurs, rather less in width than the other, and dips to the northward. The 430-feet level was driven along only a slight seam or formation in

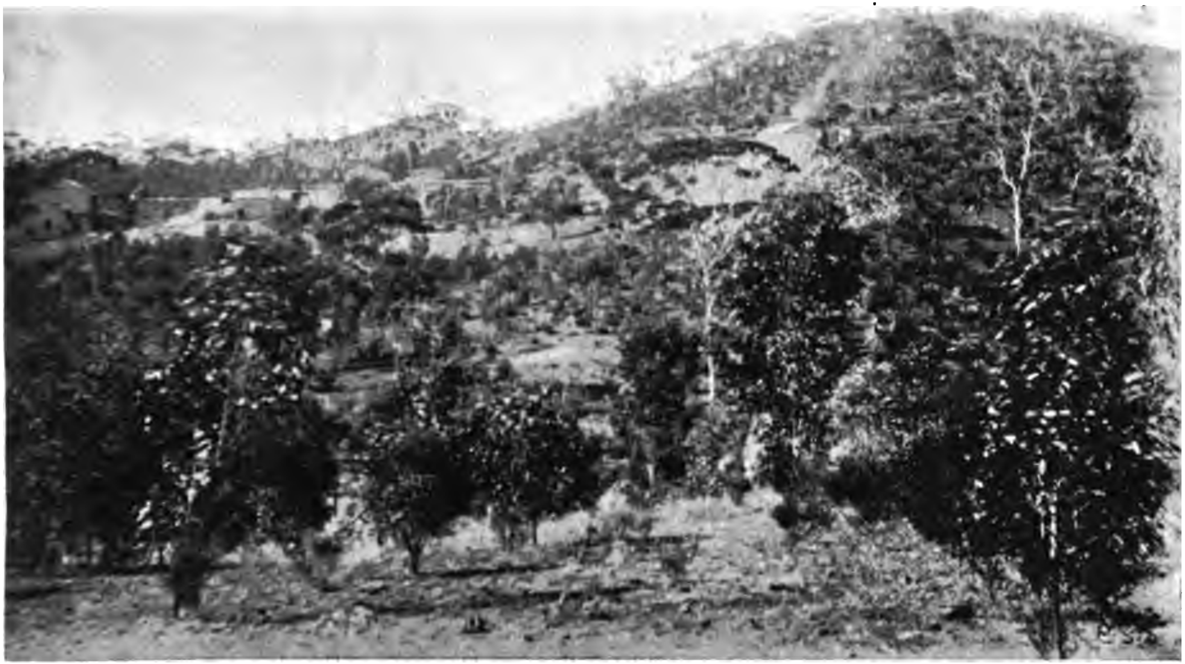


Photo., W. D. Campbell. Govt. Photo. Litho.

Lady Mary G.M., looking south, showing banded quartz and ironstone ridge on right.

called to this in the State Mining Engineer's Report for 1903, p. 55. Water for the battery is pumped through a three and a-half inch pipe, a distance of one and three-quarter miles from a well and trench at Lake Dundas, vertical lift of about 200 feet. The workings at the north end of this mine are shown in Plate IV., which is from a compass survey.

The crushings from the Lady Mary Reef are given detail in the table below.

Table showing the Yield of the Lady Mary Reef.

Year.	Name and No. of Lease.	Dollied.	Tons crushed.	Tons cyanided.	Ozs. therefrom.	Ozs. from crushings.	Remarks.
1898 ...	Lady Mary South G.M. Co., 77	...	80·00	...	...	96·30	
1899 ...	Lady Mary South G.M. Co., 738-9	...	150·00	...	...	45·50	
1900 ...	Do. ...	...	20·00	...	...	13·00	
1898 ...	Lady Mary South G.M. Co., 49	...	3799·50	...	...	4918·25	
1899 ...	Lady Mary North, 713	...	12·00	...	...	3 00	
1898 ...	Lady Mary Leases, 49, 99, 635, 636	...	9346·00	...	...	8799·66	
1900 ...	Do. ...	...	2333·00	...	...	1935·55	
1901 ...	Do. ...	...	347·00	...	...	2548·27	
1902 ...	Do. ...	...	789·00	...	...	1375·29	
1903 ...	Do. ...	...	805·00	...	...	698·61	
1904 ...	Do. ...	...	527·00	...	...	467·45	= . Silver ; = 403·43 F.
1904 ...	Do. ...	...	...	sands. 296·00	66·67	...	= 48·78 F.
1904 ...	Do. ...	...	...	slimes. 202·00	48·14	...	= 35·22 F.
1904 ...	Lady Mary G.M. Co., 49, 99, 635, 636	...	1036·00	...	...	523·85	= 445·21 F.; 10·00 Silver
				sands. 536·00	138·81	...	= 107·35 F.
				slimes. 1093·00	223·15	...	= 174·40 F.
			19344·50	sands. 832·00	205·48	21439·73	
				slimes. 1295·00	271·29	205·48 271·29	
						21916·50	or 1·133ozs. per ton

The Lucky Call Reef.

On the west side of LADY MARY SOUTH, G.M.L. 864, is the LUCKY CALL, G.M.L. 856. The original holders, Slater Bros., found a pocket of 400ozs. of gold close up to the surface and sank a shaft on a quartz formation, underlaying 70 degrees south, also an open-cut on the outcrop of the reef, but finding nothing of value they sold out to Salter and Sinclair for £5, who worked for about eight months before they struck gold in the lode. This was on the west side of the original shaft at a depth of 25 feet where the reef, 15 inches wide, passed through an ironstone band and changing to 40 degrees underlay, course 295 degrees, and a width of 10 inches, carrying very rich gold. The quartz is very dark, being mixed with ironstone [6016]. A ferruginous casing 6 inches thick flanked each side of the reef; the bottom casing also carries gold, about 1oz. to the ton. The workings are all in oxidised grounds, evidently amphibolite, and bands of ironstone. A new shaft on the west of the first one connects with the workings. This reef is probably a continuation of the Lady Mary reef, which has been deflected round the hard rock that forms the spur eastward from the north corner of this lease. Barry's Gully, which runs easterly from this lease, has been worked for auriferous alluvial for a length of about 16 chains east of the road.

The details of the crushings from this reef are given below.

Table showing the Yield of the Lucky Call Reef.

Year.	Name and No. of lease.	Dollied.	Tons crushed.	Ozs. therefrom.	Remarks.
		ozs.		ozs.	
1902 ...	Lucky Call, 856 ...	180·95	9·25	218·10	
1903 ...	Do. ...	431·05	36·00	64·83	
1904 ...	Do. ...	...	56·00	200·75	= 187·73 F.
		554·09	...	...	= 518·67 F.
		1,166·09	**101·25**	483·68	
				1,166·09	
				1,649·77	or **16·294**ozs. per ton.

The Battler Reef.

On the west side of the Lucky Call was La Mascotte, G.M.L. 857. A shaft was sunk vertically, ending with a few feet of underlay to the south; total depth, about 50 feet. This was on a quartz leader, and it was followed by a drive south-westerly till a cross vein was met with. The 212·85ozs. of gold which was returned as from this ground was found subsequently to be quite unreliable, and the prosecution which resulted fell through only on a technical point. The lease subsequently became the Alphador, G.M.L. 904. The shaft was being deepened at the time of my visit, with the expectation of picking up the continuation of the Lucky Call reef. On the west side of the last is the Alphador West, G.M.L. 933. This lease has been applied for since the writer was on the ground. It is situated on the western boundary of the banded ironstone and quartzite. South of the Alphador, and part of the Lucky Call, is the Battler, G.M.L. 920, which occupies most of the ridge, where a shaft has been sunk on the south saddle, and from which was obtained 4·85ozs.—4·08 fine—of gold by dollying, during 1904:—

Table showing the Yield of the Battler Reef.

Year.	Name of lease.	No. of lease.	Ozs. Dollied.	Remarks.
1904 ...	Battler	920	4·85	= 4·08 F.

The following table, gives in a synoptical form, the yield of the different reefs alluded to above:—

Synoptical Table showing the Yield of the Norseman Reefs up to the end of 1904.

Name of Reef.	Ore treated.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
Agnes Venture	259·50	158·99	·614
Bonanza	568·50	1,059·44	1·863
Cumberland and Mt. Benson John Bull	12,846·55	16,345·52	1·272
Desirable	5,197·50	4,182·19	·804
Excelsora Magna	30·00	7·61	·254
Federation	270·00	507·12	1·878
Golden West	94·50	61·77	·654
Hidden Treasure	218·00	176·94	·811
Kirkpatrick Reefs...	1,616·00	1,778·01	1·100
Lady Jean	1,629·00	2,767·76	1·695
Lily	635·75	324·54	·501
Lone Hand	150·00	16·50	·110
Lucky Hit	260·00	150·43	·578
Maloney	764·25	430·94	·563
Mararoa	4,581·12	5,443·00	1·188
Mararoa (various)	...	1,216·65	...
Mary Eileen	16·50	8·11	·491
Mt. Barker	714·20	354·50	·494
Mt. Kirk	5·00	·90	·180
Nellie May	135·00	1,547·10	11·460
Northern Star	2,111·55	2,263·09	1·072
Norseman	84,833·50	55,528·95	·654
O.K....	262·50	290·42	1·104
Ophir	840·75	990·19	1·177
Oversight	43·50	95·63	2·198
Princess Royal	112,602·50	135,048·87	1·199
Q.C. 103	30 00	14·11	·470
Record	121·00	136·81	1·131
Recoupe	325·00	533·87	1·643
St. Patrick	707·40	1,575·05	2·226
Star of Erin	177·50	107·34	·605
Three Colonies	407·00	351·59	·864
Union	1,343·90	975·20	·725
Valkyrie	3,168·50	3,130·85	·988
Venture	508·50	623·41	1·226
Virginia	8·00	3·94	·496
Wilgena	26·00	5·30	·204
Yield of Reefs in the Amphibolite Area	237,508·47	238,210·52	1·003

Synoptical Table showing the Yield of the Norseman Reefs up to the end of 1904—continued.

Name of Reef.	Ore treated.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
Battler	...	4·85	...
Belmont	24·50	169·20	8·694
Bon Accord	172·85	189·85	1·098
Eden Park	185·75	128·24	·690
Lady Mary	19,244·50	21,916·50	1·139
Lord Hopetoun	1,330·03	1,131·07	·850
Lucky Call	101·25	1,649·77	16·294
Narracoorte	112·50	133·66	1·188
Norseman Rose	...	19·84	...
Oriental	1,275·75	796·31	·624
Queen of the West	139·00	290·44	2·089
St. Alban's	409·50	335·50	·819
Stella May	58·00	69·04	1·190
United Miners	66·50	37·20	·559
Welcome	60·75	68·61	1·129
Wheel	170·75	122·72	·718
Ziegler's Find	154·00	731·26	4·748
Yield of Reefs in the Metamorphic Area	**23,505·63**	**27,794·08**	**1·182**
Total Yield of Reefs in both Areas	**261,014·10**	**266,004·60**	**1·019**

General.

In conclusion, the author would say that in the light of the facts that have been ascertained, there is fair reason to expect satisfactory returns from the field for some years to come, though the present heavy cost of mining tells greatly against the profitable working of the lower grade ores. Chutes of quartz, and of ore in the quartz, must be always liable to thin out both in length and depth, but may be expected to make again, but not necessarily in the same plane, hence the importance of crosscutting. The ferruginous formations in the banded quartzite and ironstone that accompany many of the small quartz veins may prove more generally profitable to open up than hitherto, both within the area of the map and as far south as it extends in the Dundas area, and also at Buldania, whenever battery and transit facilities are afforded those parts.

TABLE No. I.—*Analyses of Water from Norseman.*

By E. S. SIMPSON.

Geological Survey Laboratory No. ...	863A	864A	329B	636B	337B	368B	374B	Princess Royal G.M. water used for milling. Analysis by J. G. Woolcock.
Locality	Lake Cowan Trenches at Desirable G.M.	Lake Cowan Government Trenches, Norseman.	W.R. 146 (80).	G.M.L. 99 Lady Mary North.	W.R. 160, Mary Cater.	W.R. 167 (55).	W.R. 168.	
Potassium Chloride, KCl	·0513	·0738	·0105	·0101	...	·0034	·0049	...
Sodium Chloride, NaCl	10·4901	18·8806	·5427	1·0183	·5236	·1502	·4943	10 216
Magnesium Chloride, $MgCl_2$	1·5362	3·1905	·0222	·1328	...	·0262	·1368	1·964
Potassium Sulphate, K_2SO_4	...	...	...	...	·0048	...	...	...
Sodium Sulphate, $NaSO_4$	...	...	...	...	·0458	...	...	...
Magnesium Sulphate, $MgSO_4$	·3417	1·1324	·1037	·1836	...	·0267	·0527	·550
Calcium Sulphate, $CaSO_4$	·5393	·2238	...	·0325	..	...	...	·367
Sodium Bi-carbonate, $NaHCO_3$	...	...	...	...	·0603	...	...	...
Magnesium Bi-carbonate, $MgH_2(CO_3)_2$	...	...	·0505	...	·0994	·0624	·0312	...
Calcium Bi-carbonate, $CaH_2(CO_3)_2$ ...	·0150	·0124	·0593	·1106	·0173	·0361	·0730	...
Iron Bi-carbonate, $FeH_2(CO_3)_2$ ...	Trace	...	Trace	Trace	Trace	Trace	Trace	...
Sodium Nitrate, $NaNO_3$	...	...	...	Trace	...	...	...	...
Silica, SiO_2	Trace	Trace	·0052	·0072	...	·0077	·0094	...
Sodium Silicate, Na_2SiO_3	...	...	...	...	·0075	...	...	...
Alumina, Al_2O_3	·0058	·0044	Trace	·0012	Trace	Trace	Trace	...
Total Mineral Matter ...	12·9794	23·5179	·7941	1·4968	·7587	·3127	·8023	13·097

TABLE II.—*Analyses of Rocks from Norseman.*

By E. S. SIMPSON.

Geological Museum Number ...	5654	5428	5581	5646	5618	5455	6111	6029	6034	6119	5963	5961	5999	5650	6019	5957
Description	Dolomite.	Norite.	Norite.	Hypersthenite.	Halloysite (Mineral fat).	Felsite.	Felsite.	Porphyry.	Granite.	Dolerite.	Hornblende Mica Schist.	Biotite Schist.	Epidiorite.	Amphibolite amygdoloidal.	Metamorphic Conglomerate.	Banded Iron-stone
Specific Gravity	2·72	2·96	2·95	3·25	...	2·68	2·70	2·69	2·64	3·02	3·09	2·87	2·94	2·97	2·57	3·95
Silica, SiO_2	4·98	52·72	50·55	55·27	20·30	77·81	77·88	73·13	78·35	47·80	49·66	53·12	49·94	50·08	91·80	11·31
Carbonic Anhydride, CO_2	41·32	·04	...	...	...	...	...	·88	·19	·24	·24	·18	...	1·15	...	...
Titanic Oxide, TiO_2	·11	·61	·05	·16	...	·41	·04	·85	·18	1·23	1·43	1·16	·52	·63	1·17	...
Phosphoric Anhydride. P_2O_5 ...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	·06
Combined Water, H_2O	·62	·22	·36	·30	9·80	·44	·69	·28	·12	1·87	·46	1·58	·73	·91	1·04	4·55
Soda, Na_2O	·50	2·93	1·62	·86	2·36	4·18	3·16	3·52	2·86	2·54	·72	1·02	·90	1·69	·31	Trace
Potash, K_2O	·23	·65	·11	·18	·05	2·39	2·36	1·98	3·97	·60	1·40	5·75	·07	·15	·05	Trace
Magnesia, MgO	16·66	7·42	9·97	28·36	·22	·88	·62	·65	·61	7·40	5·04	6·15	9·64	7·21	·23	·33
Lime, CaO	28·00	10·94	14·77	2·93	·15	·05	Trace	2·81	·02	10·17	9·82	·63	11·23	12·60	·14	Trace
Manganese Protoxide, MnO ...	Trace	·30	·19	·08	Trace	·08	...	·67	·03	·40	1·53	·31	·63	·69	·27	Trace
Iron Protoxide, FeO	·92	5·53	3·40	7·17	·44	·90	...	1·68	·90	12·09	11·78	8·37	7·21	8·27		2·16
Iron Peroxide, Fe_2O_3	...	1·73	1·04	·45	...	...	·93	1·17	·61	1·25	3·11	3·97	...	1·21	1·06	76·31
Alumina, Al_2O_3	4·64	17·37	17·16	4·13	18·03	12·89	12·05	12·21	11·56	14·30	14·52	17·99	19·45	14·85	3·31	3·84
Pyrites { Fe	...	...	·08	·08	...	·10	·63	·09	·05	Trace	·03	·03	·02	·08	·03	·09
c																
S_2	...	...	·09	·09	...	·11	·72	·11	·06	Trace	·04	·04	·03	·09	·04	·11
Hygroscopic Water, H_2	1·73	·09	·12	·04	49·17	·09	·06	·21	·24	·44	·05	·14	·06	·13	·53	·85
	99·71	100·55	99·51	100·05	100·52	100·33	99·14	100·24	99·75	100·38	99·83	100·44	100·43	99·74	99·98	99·61

TABLE NO. III.—*Mineral Specimens, Dundas Goldfield.*

NORSEMAN DISTRICT.

NOTE.—† Denotes that the specimen was collected prior to the author's visit. * Denotes that the analysis of the specimen is given on Table II.

Register Number.	Register Number of Micro-slide.	Rock.	Obtained from	Locality.
5442	...	Gypsum, powdery	Surface	Bank at edge of Lake Cowan, at the Golden Bottle, G.M.L. 112
5446	...	Do. selenite	Ditch	Water Right 93
6131	...	Do. sandy	Surface	Sand ridge, Lake Cowan, old Coolgardie Road
5613	...	Laterite	do.	Norseman-Lake View, G.M.L. 777
5967	...	Do.	do.	18 chains east of Broken Hill-Dundas, G.M.L. 240
5898	...	Travertine	do.	Near top of Mt. Norcott
5899	...	Do.	do.	Half-mile west of Mt. Norcott
779†	...	Travertine, concretionary	do.	Norseman
5567	...	Marine fossil shells	do.	20 chains north-east of Mineral Lease No. 1
5568	...	Do.	do.	do. do.
5569	...	Do.	do.	do. do.
5570	...	Silicified wood, eucalyptus	do.	Norseman-Lake View, G.M.L. 777, west boundary
5571	...	Do. do.	do.	Mary Cater S.E. Extd., G.M.L. 584, south boundary
5922	...	Do. do.	do.	Norseman-Lake View, G.M.L. 777, west boundary
5923	...	Do. do.	do.	do. do.
5657	...	Bituminous silt	Dump	Mofflin's bore, in Lake Cowan
5991	...	Auriferous kaolin ore, ferruginous	Workings	Ziegler's Find, G.M.L. 907, east side of banded ironstone
6122	...	Do. do.	do.	Quartz claim, north of Lady Millar G.M.L. 938
6123	...	Do. do.	do.	do. do.
3186	...	Auriferous wash	...	Princess Royal Deep Lead
5475	...	Kaolin pug above wash	No. 2 shaft	Princess Royal Prospectors' Claim, 88ft. depth
5476	...	Do. wash or cement	No. 3 shaft	Princess Royal Prospectors' Claim, 81ft.-91ft.
6127	...	Pisolitic kaolin *	Dump	Lady May Gully, deep lead
6128	...	Do. quartz, secondary	do.	do. do.
778†	...	Dolomite	Surface	M.L. No. 1
5443	...	Do.	do.	About 35 chains north-east of Desirable North, G.M.L. 335

5617	...	Do. opalized	do.	North-west side of M.L. 1
5645	584	Do. do	Pothole	10 chains north-west of M.L. 1
5654*	567	Do.	Quarry	M.L. 1
5579	...	Magnesite	Surface	12 chains north-west of Nellie May, G.M.L. 873
5970	...	Do.	Lower adit	Hardy Norseman, G.M.L. 21, in fissure
737	...	Norite	...	
5438*	453	Do.	Surface	On road about 35 chains south-west from Trig. B/22
5439	454	Do.	do.	do. do. do.
5482	...	Do.	do.	Trig. Hill B/22, north side, 80ft. above road
5577	...	Do.	do.	Rock, near road, 19 chains west of Lake Cowan
5578	...	Do.	Dump	W.R. 167 (55), south well
5581*	596	Do.	Cliff	West side Lake Cowan, 1st point south of Causeway.
5590	...	Do. peridotite	Surface	West side Lake Cowan, between 1st and 2nd point of Causeway
5646*	565	Do. hypersthenite	do.	55 chains east from east end of Causeway
5649	605	Do.	do.	Ridge, 30 chains west of M.H.L. 19
5651	604	Do.	Well	Half mile south-west of Mt. Norcott, 20ft. depth
5652	...	Do.	Surface	North-west foot of Mt. Norcott
5653	...	Do.	do.	¾ mile west of Mt. Norcott
5891	...	Do.	do.	15 chains southerly from spec. 5577
5892	564	Do.	do.	1¼ miles west of west side Lake Cowan
5896	603	Do.	do.	North side of Mt. Norcott
5897	...	Do. coarsely crystalline	do.	¼ mile north of Mt. Norcott
5589	...	Epidote (?) veins	do.	west side Lake Cowan, where Coolgardie road strikes edge of lake
5647	...	Do. (?) do.	do.	55 chains east of Causeway, south boundary of norite
5932	...	Do. (?) do.	12ft. depth	Star G.M.L. 835, east shaft, green material on slide face
5952	...	Do. (?) do.	V.D. 70	Lady Jean, G.M.L. 757, new shaft, north drive
1988†	...	Auriferous quartz in amphibolite	...	Viking Norseman, G.M.L. 26, 450ft. level, assays a.u. 1·019, a.ag. 1·100
3185†	...	Auriferous quartz in banded ironstone	...	Alickazander, G.M.L. 770
5454	...	Quartz reef	340ft. level	Princess Royal, G.M.L. 106, 340ft
5459	...	Do.	do.	do. do.
5460	...	Quartz vein in hanging wall	300ft. level	Princess Royal, G.M.L. 106, 340ft., 130ft. south from No. 7 shaft

TABLE No. III.—*Mineral Specimens, Dundas Goldfield*—continued.

NORSEMAN DISTRICT—*continued.*

Register Number.	Register Number of Micro-slide.	Rock.	Obtained from	Locality.
5461	...	Quartz reef, showing gold ...	300ft. level ...	Princess Royal, G.M.L. 106, 340ft.
5474	...	Quartz reef, barren	250ft. level ...	Princess Royal South Extended, G.M.L. 647, east drive
5597	...	Veined amphibolite with pyrites	240ft. level ...	Valkyrie, G.M.L. 831
5601	...	Iridescent quartz		Near Record, G.M.L. 901
5905	...	Quartz reef in quartzite	Dumps	Welcome Stranger, G.M.L. 585
5912	...	Vuggy quartz	Main shaft ...	Norseman No. 1 North, G.M.L. 16
5914	...	Quartz reef	North end workings	do. do.
5919	...	Siliceous sinter	Costeen	Mary Cater North Extended, G.M.L. 604
5929	586	Auriferous quartz	Underlay shaft ...	St. Patrick, G.M.L. 849
5937	...	Quartz reef	Main shaft ...	Bon Accord, G.M.L. 95
5945	590	Do. in quartzite	Dump	Agnes Venture, G.M.L. 782, central underlay shaft
5950	...	Do. sulphide ore	do.	do. do. do.
5971	...	Reef casing	Upper adit ...	Sydney Norseman, G.M.L. 20, north end. (Assay, a.u. 1dwt. per ton)
5972	...	Quartz reef and casing	No. 2 level ...	Mildura
5974	...	Do. and calcite	Lower adit ...	Hardy Norseman, G.M.L. 21, north end
5977	...	Pyrites from reef	No. 3 level ...	Cumberland, G.M.L. 579, main vertical shaft, north end
5978	...	Lode stuff	do.	Cumberland, G.M.L. 579, main vertical shaft, north end, assays 10grs. per ton
5979	...	Quartz reef	No. 1 level ...	Mt. Benson, G.M.L. 43, east reef
5981	...	Do. pay. ore	No. 2 level ...	do. Extended, G.M.L. 42, drive east
5982	...	Do. do.	do.	do. do. do. west
5983	...	Do. do.	No. 1 level ...	do. do. do. east
5988	...	Do. with carbonate of copper	Dump	Athelstone, G.M.L. 325, north shaft
5989	...	Do.	Workings ...	Ajax, G.M.L. 882, at crossing in quartz porphyry dyke

5990	...	Tabular quartz on footwall side of reef	Between 60ft. and 100ft.	Northern Star, G.M.L. 821
5992	...	Quartz with mica	100ft.	Norseman No. 1 North, G.M.L. 16
5993	...	Do. , with halloysite	No. 2 level ...	Mildura Norseman, G.M.L. 18
5997	...	Do.	Dump	G.G., G.M.L. 905, north shaft
5998	..	Do. showing gold	No. 1 level ...	O.K., G.M.L. 903
6016	...	Do. in ironstone, showing gold	Prospectors' shaft	Lucky Call, G.M.L. 856
6023	...	Do. do. do.	Surface	Perseverance, G.M.L. 866
6026	...	Do. pay. ore	No. 3 level ...	Lady Mary North, G.M.L. 99
6027	...	Do. do.	No. 4 level ...	Lady Mary North, G.M.L. 99, winze 440ft. north of No. 7 shaft
6041	...	Do. do.	Workings ...	Queen Alexandra, G.M.L. 923
6043	...	Do. do.	80ft. level ...	Admiral Togo, G.M.L. 919, main shaft
6118	...	Do. do.	870ft. V.D. ...	Princess Royal Central, G.M.L. 840
5973	...	Do. with incrustation of asbolite	Upper adit ...	Sydney Norseman, G.M.L. 20
733†	...	Asbolite, black hydrated oxide, cobalt, and manganese	...	Princess Royal, G.M.L. 106
5618*	..:	Halloysite (mineral fat)	125ft. level ...	Desirable, G.M.L. 848, south drive
6044	...	Pyrites from reef	80ft. level ...	Admiral Togo, G.M.L. 919, main shaft
6117	...	Pyriteous band 9 inches thick ...	573ft. V.D. ...	Princess Royal Central, G.M.L. 840
6126	...	Azurite encrusting ironstone ...	Surface	Lady Mary Block, Claim 1, G.M.L. 635
6573	...	Banded quartz and ironstone, lode showing gold	About 150ft. V.D.	G.M.L. 938, Lady Millar
5465	459	Opaline quartz	Surface	25 chains north-east of Desirable North, G.M.L. 335
5592	...	Do.	do.	South boundary of norite west side of Lake Cowan
736†	...	Felsite	130ft. level ...	Princess Royal South Extended, G.M.L. 647, footwall side of reef
5455*	457	Do.	340ft. level ...	Princess Royal No. 1 South, footwall 70ft. from south boundary
5481	...	Do.	Surface	Golden West, G.M.L. 650, south corner
6037	595	Do.	No. 3 bore ...	Princess Royal, G.M.L. 106, at 380ft. level
6108	...	Do.	220ft. level ...	Princess Royal, G.M.L., east reef, crosscut at 66ft.
6109	...	Do., kaolinized	220ft. level ...	Princess Royal, G.M.L., east reef end north drive
6110	...	Do.	300ft. level ...	Princess Royal No. 1 South, G.M.L. 187, 430ft. south of No. 7 shaft

TABLE NO. III.—*Mineral Specimens, Dundas Goldfield*—continued.

NORSEMAN DISTRICT—*continued.*

Register Number.	Register Number of Micro-slide.	Rock.	Obtained from.	Locality.
6111*	577	Felsite, Foliated	Between 255 and 300	Princess Royal, G.M.L. 106, near spur reef
5449	...	Quartz Porphyry	Surface	West side of hill 2 miles north from Princess Royal
5451	...	Do.	do.	East side of hill 2 miles north of Princess Royal
5463	...	Do.	do.	Mt. Barker No. 5 North, G.M.L. 109
5467	...	Do.	Cliff	Near old sports ground, Lake Cowan
5483	...	Do.	Surface	Royal Prince, G.M.L. 810, crossing west boundary.
5598	...	Do.	No. 3 level	Valkyrie, G.M.L. 831, hanging wall of reef south of main shaft
5599	...	Do.	240ft. level	Valkyrie, G.M.L. 831, end of south drive
5612	598	Do. crushed	Dump	Mt. Barker No. 6 North, G.M.L. 668
5656	...	Do. dark-coloured	Surface	Cachuanca, G.M.L. 19
5894	...	Do.	do.	Great Bonanza, G.M.L. 560, south-west corner
5895	...	Do. mineralised	do.	7 chains N.N.E. from S.E. corner of Union Jack, G.M.L. 588
5948	...	Do. black	do.	4 chains east of N.E. corner Agnes Venture, G.M.L. 781
5969	592	Do. slaty	No. 2 level	Mildura Norseman, G.M.L. 18
5976	...	Do. pyritous	Quarry	Cumberland, G.M.L. 579, north corner
5984	...	Do. foliated	Surface	John Bull, G.M.L. 53, east side of dyke
5600	...	Do. banded	do.	10 chains south of Q.A. 19
5943	589	Do. do.	do.	6 chains S.W. from S. corner of Lucky Hill, G.M.L. 369
5944	...	Do. do.	do.	5 chains west of N.W. corner of Golden Crown, G.M.L. 373
5946	600	Do. do.	do.	Albert Edward, G.M.L. 331, west boundary
5947	...	Do. do.	do.	8 chains west of Blue Ensign, G.M.L. 372, same dyke as 5943
5949	...	Do. do.	do.	Agnes Venture, G.M.L. 782
5968	...	Do, do,	Dump	Albert Edward, G.M.L. 331, north shaft near quartzite

6120	...	Do. do.	168ft. level	Cumberland East, G.M.L. 896, first dyke east of new shaft
6121	...	Do. do.	do.	Cumberland East, G.M.L. 896, second dyke east of new shaft
6031	...	Do. do.	Surface	East side of Lake Dundas, west side of M. spec. 6029
6029*	571	Porphyry	Surface	East side of Lake Dundas, two miles from Government tank
6032	607	Do.	do.	do. do. do.
6033	597	Do.	do.	do. do. do.
5940	588	Felspar porphyry	do.	Five chains east from Golden Gully, G.M.L. 328, near Lake Dundas
5591	581	Pegmatite veins	do.	West side of Lake Cowan at south boundary of norite
6035	...	Do. after aplite	do.	East side of Lake Cowan, about two miles east of Government tank
6036	...	Do. do.	do.	do. do. do.
5913	585	Granite porphyry (?)	100ft. level	Norseman No. 1 North, G.M.L. 16, accompanies reef
5985	594	Granite porphyry	Surface	Mt. Benson No. 1 Extended, G.M.L. 52, eastern dyke
6004	606	Do. do.	Dump	Italia, G.M.L. 165, shaft on east side
6034*	572	Granite	Surface	East side of Lake Dundas, about two miles east of Government tank
6119	578	Dolerite	No. 1 level	Mt Benson North, G.M.L. 42, drive east
5471	613	Diorite	250ft. level	Princess Royal South Extended, G.M.L. 647, main shaft, west crosscut
5480	...	Do.	Surface	Foot of hill, 19 chains northerly continuation of south side G.M.L. 335
5995	562	Do.	Near surface	G. G., G.M.L. 905, south of north shaft
5935	...	Do. porphyritic	No. 1 level	Bon Accord, G.M.L. 95, main shaft
5942	601	Mica diorite	Surface	1¼ chains east of north-east corner of Belmont, G.M.L. 789
5963*	569	Hornblende mica schist, probably same dyke as last	About 100ft.	Bon Accord, G.M.L. 95, main shaft
5961*	568	Biotite schist, probably same dyke as last	...	1¼ chains east of north-east corner of Belmont, G.M.L. 789
5962	...	Do. weathered	Surface	do. do. do.
5440	...	Epidiorite	Dump	Moonta Norseman, G.M.L. 449
5441	455	Do.	120ft. level	Desirable No. 2, G.M.L. 85

TABLE No. III.—*Mineral Specimens, Dundas Goldfield*—continued.

NORSEMAN DISTRICT—*continued.*

Register Number.	Register Number of Micro-slide.	Rock.	Obtained from.	Locality.
5444	...	Epidiorite	Dump	Three Colonies, G.M.L. 88, main shaft
5588	616	Do. aphanitic	Cliff	3rd point south of Causeway, west side Lake Cowan
5999*	570	Do.	Cliff	Sunbeam, G.M.L. 157, east boundary
6024	...	Do.	Surface	1,000ft. westerly on ridge from G.M.L. 720, Lady Mary N. Central
734†	...	Amphibolite	140ft. level	Princess Royal, G.M.L. 106, main shaft
5448	456	Do. aphanitic	Surface	Hilltop, two miles north of Princess Royal
5450	...	Do. coarse-grained	do.	Eastern shoulder of hill
5462	458	Do.	About 200ft.	Lady Mary, G.M.L. 49, main underlay shaft
5464	...	Do.	Dump	Mildura Norseman, G.M.L. 18
5468	...	Do.	Surface	Edge of Lake Cowan, two miles N. of Princess Royal
5469	...	Do. aphanitic	do.	Near old sports ground, Lake Cowan
5470	...	Do.	do.	East side of hill, sports ground, Lake Cowan
5472	614	Do. coarse-grained	250ft. level	Princess Royal South, G.M.L. 647, crosscut east to reef
5473	...	Do.	do. do.	Princess Royal, G.M.L. 647, hanging wall of reef
5477	...	Do. oxidised	88ft. do.	Princess Royal deep lead, prospector's claim, No. 2 shaft
5478	...	Do. kaolinised	92ft. do.	Bed of deep lead, prospector's claim, Princess Royal
5479	...	Do. decomposed	Surface	13 chains east of east corner of Moonta Norseman, G.M.L. 449
5573	...	Do. aphanitic	Main shaft	Princess Royal North, G.M.L. 186
5574	...	Do. do.	370ft. shaft	do. do. do.
5575	...	Do. do.	250ft. shaft	do. do. do. crosscut west
5580	...	Do. hornblendic	Quarry	West end of Causeway across Lake Cowan
5582	...	Do. with bedding planes	Cliff	North side of island, near water lease No. 2
5583	...	Do.	do.	North side of east end
5586	...	Do. coarsely crystalline	do.	West side of Lake Cowan, point near M.H.L. 18
5587	615	Do. chloritized (?)	do.	2nd point south of Causeway, west side of Lake Cowan
5593	582	Do.	do.	Cliff, 40 chains west of large island
5594	...	Do.	240ft. level	Valkyrie, G.M.L. 831

5595	617	Do.	...	140ft. „ ...	Valkyrie, G.M.L. 831
5596	617	Do.	...	240ft. „ ...	Valkyrie, G.M.L. 831, north drive, hanging wall
5619	...	Do.	...	500ft. „ ...	Princess Royal, G.M.L. 109
5648	...	Do.	...	Surface ...	Top of hill, south of M.H.L. 19
5650*	566	Do.	amygdaloidal ..	Cliff ...	West side of Lake Cowan, at 102m, 18 chains on railway
5903	...	Do.	decomposed ...	Dump ...	Norseman Star North, G.M.L. 398
5909	...	Do.	coarsely crystalline	Surface ...	Little Jim, G.M.L. 786, west side of banded quartzite
5934	...	Do.	do. ...	Dump ...	St. Albans, G.M.L. 55
5953	...	Do.	...	South-west shaft	Lady Jean, G.M.L. 757
5955	...	Do.	kaolinised ...	Surface ...	St. Albans, G.M.L. 55
5956	...	Do.	do. ...	do. ...	do. do. between banded quartzite
5959	591	Do.	...	do. ...	Five chains from south-east corner Welcome, G.M.L. 410
5975	...	Do.	...	No. 2 level, north end	Pride of Scotland, Norseman, G.M.L. 24
5980	593	Do.	...	300ft. level ...	Mt. Benson Extended, G.M.L. 42
5987	...	Do.	...	168ft. level ...	Rising Sun, G.M.L. 71, shaft east corner of lease
5994	602	Do.	...	Dump ...	Alice, G.M.L. 354, north shaft
6005	...	Do.	...	Surface ...	Sunbeam, G.M.L. 157, 1 chain north of south boundary
6006	...	Do.	aphanitic ...	do. ...	Norseman Prop., G.M.L. 532, north-west corner
6008	...	Do.	...	do. ...	do. do. 11 chains north of south-east corner
6010	...	Do.	aphanitic ...	do. ...	Main Ridge, 30 chains south of trig. station B/22, Woolyeanger
6011	...	Do.	do. ...	do. ...	Main Ridge, 9 chains south of trig. station B/22, Woolyeenyer
6012	...	Do.	decomposed ...	do. ...	Low part of spur north-east from trig. station B/22, Woolyeanger
6013	...	Do.	aphanitic ...	Upper shaft dump	About 29 chains south of south-west corner Waterloo, G.M.L. 356
6020	...	Do.	do. ...	Cliff at telegraph line	Five chains east of Kirkham, G.M.L. 172
6025	...	Do.	with siderite ...	Dump ...	Sudden Norseman, G.M.L. 44, shaft on east boundary
6038	618	Do.	aphanitic ...	No. 3 bore ...	Princess Royal, G.M.L. 106
6040	...	Do.	...	No. 1 bore ...	do. do. about 48in. bore
6112	...	Do.	mineralised ...	380ft. level ...	do. do. do.
6113	...	Do.	...	500ft. level ...	do. do. main crosscut

Table No. III.—*Mineral Specimens, Dundas Goldfield*—continued.

Norseman District—*continued.*

Register Number.	Register Number of Micro-slide.	Rock.	Obtained from	Locality.
6114	...	Amphibolite, slaty...	500-ft. level ...	Princess Royal, G.M.L. 106, 320ft. south of main shaft
6115	...	Do. mineralised ...	No. 9 bore ...	Princess Royal Extended, G.M.L. 587, after passing quartz vein
5452	...	Do. schist carbonated ...	300-ft. level ...	Princess Royal, G.M.L. 106, crosscut from main shaft
5453	...	Do. do. footwall	do. ...	do. do. do.
5457	...	Do. schist	340-ft. level ...	Princess Royal No. 1 South, G.M.L. 187, near north boundary
5576	...	Do.	250-ft. level ...	Princess Royal North, G.M.L. 186, north drive hanging wall
5585	...	Do.	Cliff	East side of island west of Water Lease, No. 2
5915	...	Do.	200-ft. level ...	Norseman No. 1 North, G.M.L. 16
6039	...	Do.	Bore No. 3 ...	Princess Royal, G.M.L. 106
735†	...	Chlorite schist, oxidised	Near surface ...	do. do.
5445	...	Do.	Dump	Three Colonies, G.M.L. 88, main shaft
5456	...	Do.	340-ft. level ...	Princess Royal No. 1 South, G.M.L. 187
5458	...	Do.	380-ft. level ...	Princess Royal, G.M.L. 106, near east boundary
5655	599	Amphibolite, actinolitic	Dump	Great Boulder, G.M.L. 104, shaft east of Q.P.
5936	587	Do. do.	do.	Bon Accord, G.M.L. 95, main shaft
6015	...	Do. do. with iron-stone bands	Surface	Lady Mary South, G.M.L. 864
6021	576	Do. do. do. ...	Adit	Lady Millar, G.M.L. 876, 4 chains from mouth
6022	...	Do. do. do. ...	Dump	Alickazander, G.M.L. 770, N.-W. shaft
6028	...	Do. do. do. ...	No. 4 level ...	Lady Mary North, G.M.L. 99, winze 440ft. north of main shaft
6042	...	Do. metamorphosed ...	Surface	4 chains east of Welcome, G.M.L. 403, top of ridge
6116	...	Do. do. ...	No. 9 bore ...	Princess Royal Extended, G.M.L. 587, at 236ft.
5996	...	Mica schist	Dump	G.G., G.M.L. 905, between Q.P.
6007	...	Mica	Surface	Norseman Prop., G.M.L. 532, east side
6014	...	Do.	Pothole	Opawa, G.M.L. 739, near south-west corner
6030	..	Do.	Surface	East side of Dundas Lake 2 miles E. of Government tank
6046	...	Graphitic schist from hanging wall	Dump	Valkyrie Extd., G.M.L. 880, shaft near N.-E. corner
6047	...	Mamilated quartz accompanying hanging wall	do.	do. do. do.
5584		Metamorphosed sandstone ..	Surface ..	Near south-east corner Mary Cater South Extended G.M.L.

5904	...	Do. do.	do.	Welcome Stranger, G.M.L. 585, south-east corner
5907	...	Do. do.	do.	Little Jim, G.M.L. 780, east side of quartzite
5908	...	Do. do.	do.	do. do. west do.
5911	...	Do. do.	do.	Five chains north of Little Jim No. 1 North, west side of quartzite
5916	...	Do. do. breccia	Trench	Queen of the West, G.M.L. 390, east side of quartzite
5917	...	Do. do.	Surface	Five chains south of Transvaal, G.M.L. 771
5918	...	Do. conglomerate	do.	Near north-east corner Little Jim, G.M.L. 628
5930	...	Do. do.	do.	Tapio, G.M.L. 550
5931	...	Do. do. mineralised	do.	do.
5938	...	Do. do.	do.	Belmont, G.M.L. 789. (*See* illustration.)
5954	...	Do. sandstone, kaolinised	Dump	Narracoorte, G.M.L. 161, north shaft
5964	...	Do. sandstone coloured red by oxide of iron	Surface	Near Albany Proprietary, G.M.L. 349, west side
6009	...	Do. sandstone	do.	Mt. Rugged, G.M.L. 562, near south-west corner
6017	575	Do. do.	do.	Great Eastern, G.M.L. 448, 7 chains north of
6019*	563	Do. do.	Open cut	Stella May, Q.C. 151
6129	579	Do. conglomerate	do.	Bon Accord G.M.L. 95, east side of main shaft
5466	...	Banded quartzite	Surface	W.R. 160, south of well
5993	...	Quartzite, green-coloured	do.	Welcome Stranger, G.M.L. 585, 10 chains south of
5902	...	Banded quartzite	do.	Emerald, G.M.L. 420, north end
5910	...	Do. decomposed	do.	6 chains north of Little Jim No. 1 North, G.M.L. 788
5920	...	Do. with opaline quartz	Costeen	Mary Cater North Extended, G.M.L. 604
5921	...	Do.	do.	do. do.
5939	...	Quartzite, green-coloured	Surface	22 chains east of Golden Gully, G.M.L. 328
5933	...	Opaline quartz in quartzite	Pothole	Vale, G.M.L. 838
5941	...	Banded quartzite with chalcedony	Adit	5¼ chains east of Albany Propy., G.M.L. 349
5951	...	Do.	Surface	Golden Crown, G.M.L. 373, north-east corner
5965	...	Do.	do.	10 chains south-east of north-west corner of Welcome Stranger, G.M.L. 565
6002	...	Do.	Shaft	Pluto No. 2 North, G.M.L. 276, east corner
6003	...	Do.	do.	
6130	580	Do.	Pothole	Bon Accord, G.M.L. 95, 3ft. east of M. spec. 6129
1602*	...	Banded ironstone, auriferous	Workings	Ziegler's Find, G.M.L. 907
5906	...	Do.	Pothole	Little Jim, G.M.L. 786
5957*	...	Do.	Open cut	Hit or Miss, G.M.L. 863
5958	...	Do. auriferous	Incline shaft	Tarpeena, G.M.L. 192, east side
5966	...	Do.	Surface	11 chains east of Lady Bella, G.M.L. 783
6018	...	Do. with magnetite	do.	47 chains east of Morell, G.M.L. 666

TABLE NO. III.—*Mineral Specimens, Dundas Goldfield*—continued.

Register Number.	Register Number of Micro-slide.	Rock.	Obtained from.	Locality.
			PENINSULA.	
6124	...	Banded quartzite with magnetite	Surface	16 chains north-east of Great Eastern, G.M.L. 448
6125	...	Do. do. do.	do.	Lady Mary Block, Claim 1, south-east corner
713†	...	Schist, decomposed, showing gold	100-ft. level	Day Dawn, G.M.L. 129, Central Wealth G.M.
741†	...	Slate	200-ft. level	do. do. do.
742†	...	Felstone, schistose	200-ft. level	do. do. do.
			BULDANIA GROUP.	
738†	...	Molybdenite	...	Buldania Bell, G.M.L. 779
739†	...	Hornblende schist	...	Birthday Gift, G.M.L. 736
740†	...	Lodestuff	70-ft. level	Northern Ajax, G.M.L. 502
5900	...	Granite	Surface	Buldania road, two miles west of track to Mt. Norcott
5901	...	Amphibolite, slaty	do.	do. quarter mile east of last
5924	...	Quartz Porphyry	do.	Birthday Gift, G.M.L. 736, near Wooden Battery
5925	...	Amphibolite schist	Dump	Buldania Bell, G.M.L. 779, shaft top of hill
5926	...	Sulphide ore	do.	do. do. do.
5927	561	Porphyritic diorite	do.	Mia Mia, G.M.L. 676
5928	...	Casing of reef	do.	do. do.
			DUNDAS DISTRICT.	
5602	583	Granite	Surface	Noganyer Soak, Dundas
5603	...	Pegmatite vein	do.	East side of Mt. Henry, Dundas
5604	...	Mica schist	do.	do. do. adjacent to last
5605	...	Amphibolite schist	do.	East, foot of Mt. Henry
5606	...	Auriferous quartz	Workings	Maybell, G.M.L. 4 (Mawson's Reward)
5607	...	Amphibolite	Surface	East side Mt. Henry, Dundas
5608	...	Do.	Dump	Maybell, G.M.L. 4, Dundas
5609	...	Leaf gold on quartz	do.	Gem, G.M.L. 809, Dundas
5610	...	Quartz and mica schists	Surface	Hill east side of Dundas between two quartz reefs
5611	...	Quartz with gold and copper	do.	Hill east side of east reef between two quartz reefs.

INDEX TO NAMES OF PLACES, MINES, REEFS, Etc.

Page

Absent-Minded Beggar Lease ... 104, 105
Admiral Togo Lease ... 104, 123
Agnes Venture Lease ... 78, 80, 116, 122, 124
Agnes Venture North Lease ... 79
Ajax Lease ... 37, 73, 122
Albany Lease ... 99
Albany Proprietary Lease ... 129
Albert Edward Lease ... 107, 124
Alice Lease ... 89, 127
Alickazander Lease ... 110, 111, 121, 128
All Nations Lease ... 55, 56
All Nations Extended Lease ... 55
Alluvial Gold ... 9
Alma Lease ... 104
Alphador Lease ... 115
Alphador West Lease ... 115
Amphibolite ... 6, 19, 20, 31, 116, 119, 121, 126, 128, 130
Amy Castles Lease ... 104, 105
Anchor Lease ... 110
Angove, Inspector ... 39, 41, 42, 53, 54, 55, 56, 57, 60, 61, 73, 74, 78, 79, 80, 81, 82, 83, 87, 88, 89, 90, 91, 92, 95, 96, 97, 99, 100, 101, 102, 105, 106, 107
Arcadia Lease ... 78
Archæan Age ... 7
Asbolite ... 67, 123
Athelstone Lease ... 89, 122
Auraria Lease ... 90
Aveline Quartz Claim ... 51
Avon Lease ... 86, 87
Azurite ... 123

Banded Ironstone ... 119
Bandit King Lease ... 106
Battler Lease ... 115, 116, 117
Belmont Lease ... 34, 98, 117, 125, 129
Bethnal Green Quartz Claim ... 55, 56
Biotite Schist ... 119
Birthday Gift Lease ... 130
Bismuth ... 37
Bituminous Silt ... 120
Blatchford, T. ... 17
Block 14 Proprietary ... 59
Block 512 ... 107
Blue Ensign Lease ... 107, 124
Blue Flag Lease ... 79
Bohemian Lease ... 60, 61
Bon Accord Lease ... 30, 33, 34, 97, 98, 117, 122, 125, 128, 129
Bon Accord No. 1 South Lease ... 98
Bon Accord South Lease ... 98
Bonanza Lease ... 71, 72, 73, 116
Bonanza Block No. 1 Lease ... 71

Page

Braeside Lease ... 104, 105
Break-o'-Day Lease ... 35
Britannia Lease ... 108
British Norseman Lease ... 55
Brocklesby Lease ... 78
Broken Hill-Dundas Lease ... 120
Broome Hill Lease ... 107
Buldania Lease ... 31, 35
Buldania Bell Lease ... 130
Bulletin Lease ... 74, 76

Cachuanca Lease ... 67, 124
Caledonia Lease ... 103
Caledonian Lease ... 80
Canny Scotchman Lease ... 79
Canton Lease ... 81, 82
Castlemaine Lease ... 54
Catlin, Arthur ... 18, 35, 39, 48, 59, 65, 92
Celt Lease ... 65
Chewings, Dr. Charles ... 17, 33
Chlorite Schists ... 6
Christmas Gift Lease ... 104
Clarence Lease ... 110
Come Again Lease ... 53, 54
Conglomerate ... 119
Cornstalk Lease ... 79
Coromandel Lease ... 74
Cosmopolitan Lease ... 55
Criterion North Lease ... 42
Cumberland Lease ... 7, 25, 29, 32, 36, 87, 88, 116, 122, 124
Cumberland East Lease ... 91, 93, 125
Cumberland Extended Lease ... 92
Cumberland West Lease ... 89
Cumberland West Extended Lease ... 89

Daisy Lease ... 101
Day Dawn Lease ... 130
Dead Finish Quartz Claim ... 74
Desirable Lease ... 25, 31, 40, 116, 118, 123
Desirable Block Lease ... 40
Desirable Extended Lease ... 40
Desirable North Lease ... 42, 120, 123
Desirable No. 1 Lease ... 38
Desirable No. 2 Lease ... 39, 125
Desirable Proprietary Lease ... 38
Desirable South Lease ... 39
Diorites ... 6, 19, 29, 30
Discovery Reef ... 87
Dolerite ... 7, 19, 29, 119
Dolomite ... 19, 21, 22, 119, 120, 121
Dundas Hills ... 10
Dundas Reward Claim No. 1 ... 10

Early Dawn Lease ... 92
Eastern Goldfields ... 7
Eden Park Lease ... 95, 117
Eden Park No. 1 South Lease ... 95
Eden Park South Extended Lease ... 95

Page

Edinburgh Castle Lease ... 104, 105
Emerald Lease ... 129
Epidiorites ... 6, 19, 31, 119, 125, 126
Epidote ... 121
Esperanza Lease ... 56
Etheridge, R., jun. ... 22
Eucalypti Wood ... 22
Euclid Lease ... 54
Eureka Lease ... 88, 89
Evening Star Lease ... 85
Excelsior Lease ... 55, 56
Excelsora Magna ... 89, 116

Federation Lease ... 50, 51, 116
Felsite ... 19, 27, 119, 123, 124
Felspar Porphyries ... 19, 29, 125
Ferruginous Jaspers ... 6
Florence Lease ... 101
Fossil Shells ... 120

Galena ... 37
Gem Lease ... 130
G. G. Lease ... 123, 128
Gift Lease ... 61, 62
Gipsy Girl Lease ... 60
Gladstone Lease ... 53
Gladstone Extended Lease ... 53
Gladstone North Lease ... 53
Glasgow Lease ... 61, 62
Göczel, S. ... 7, 14, 15, 33
Golden Allie Lease ... 57, 58
Golden Bar Lease ... 57
Golden Bottle Lease ... 42, 120
Golden Bug Quartz Claim ... 106
Golden Calf Lease ... 64
Golden Crown Lease ... 124, 129
Golden Dyke Lease ... 57
Golden Gully Lease ... 98, 125, 129
Golden King Lease ... 101
Golden West Lease ... 42, 43, 116, 123
Granite Porphyries ... 19, 24
Great Barrier Lease ... 103
Great Bonanza Lease ... 103, 124
Great Boulder Norseman Lease ... 79, 81, 128
Great Eastern Lease ... 110, 129, 130
Great Norseman Junction Lease ... 73
Greenstones ... 7, 8
Gypsum ... 19, 21, 120

Halloysite ... 39, 58, 66, 119, 123
Hardy Norseman Lease ... 67, 121, 122
Hidden Treasure Lease ... 49, 50, 116
Highfield Lease ... 73
Hit or Miss Lease ... 105, 106, 129
Holstein North Lease ... 107
Holstein No. 1. Lease ... 109
Holstein No. 1 North Lease ... 108

Page

Homeward Bound Lease ... 55
Hope Lease ... 90
Hornblende Mica Schist ... 119
Horseshoe Lease ... 103, 105
Hosking Lease ... 111
Howestake Lease ... 95
Hyperstheníte ... 119

Iona Lease ... 43
Iris Lease ... 58
Ironsides Lease ... 78
Ironstone Gravel ... 19
Italia Lease ... 24, 94, 125

Jessie Margaret Lease ... 60, 61
John Bull Lease ... 7, 85, 86, 88, 124
Johnson's Reef ... 86
Joker Lease ... 82
Josephine Lease ... 78

Kadinoe Lease ... 92
Kaolin ... 20, 120
Kaolinite ... 66
Kingswood Lease ... 80
King William Lease ... 52
Kirkham Lease ... 127
Kirkpatrick Consolidated Lease ... 91
Kirkpatrick Lease ... 116
Kirkpatrick Mt. Benson Lease ... 87, 90, 91
Kirkpatrick Mt. Kirk Lease ... 94
Klondyke Lease ... 73
Kyneton Lease ... 52

Lady Alice Lease ... 78
Lady Argyle Lease ... 78
Lady Bella Lease ... 108, 109, 129
Lady Bella North Lease ... 108
Lady Bella South Lease ... 107, 108
Lady Clara Lease ... 54
Lady Ellen Lease ... 53
Lady Jean Lease ... 81, 82, 110, 111, 116, 121, 127
Lady Jean North Lease ... 81
Lady Mary ... 25, 32, 37, 112, 113, 114, 117, 126
Lady Mary Block Claim No. 1 Lease ... 112, 123, 130
Lady Mary Block Claim No. 2 Lease ... 112
Lady Mary Deep Lead ... 19, 36
Lady Mary Extended Lease ... 110, 111
Lady Mary Extended North Lease ... 110
Lady Mary Extended No. 1 Lease ... 111
Lady Mary North Lease ... 112, 114, 118, 123, 128
Lady Mary North Extended Lease ... 110
Lady Mary North Central Lease ... 126
Lady Mary North Junction Lease ... 110
Lady Mary North No. 1 Lease ... 111
Lady Mary South Lease ... 112, 114, 128
Lady Millar Lease ... 33, 110, 123, 128

Page

Lady Millar Extended Lease ... 110, 111
Lady May Gully ... 120
Lake Cowan ... 7, 9, 13, 20, 23, 31, 32, 118, 120, 121, 123, 125, 126, 127
Lake Dundas ... 6, 7, 9, 13, 20, 28
Lake Kirk ... 6, 13, 23, 31
La Mascotte Lease ... 100, 115
Laminated Quartzite ... 6
Last Chance Lease ... 60, 95
Laterite ... 8, 13, 19, 20, 120
Leviathan South Lease ... 104
Lilly Lease ... 57, 58, 116
Little Beatrice Lease ... 78
Little Jim Lease ... 96, 127, 129
Little Jim No. 1 North Lease ... 96, 129
Little Pearl Lease ... 38, 40
Little Rachael Lease ... 78
Livingstone Lease ... 57
Lone Hand Lease ... 82, 116
Lone Star Lease ... 103
Lord Hopetoun Lease ... 37, 103, 104, 105, 117
Lord Hopetoun Extended Lease ... 104
Lucindale Lease ... 57
Lucky Call Lease ... 26, 114, 115, 117, 123
Lucky Hill Lease ... 75, 124
Lucky Hit Lease ... 52, 116
Lucky Shot Lease ... 93

Macedonia Lease ... 60
Magnesite ... 120
Magnetite ... 14, 26
Maloney Lease ... 52, 53, 54, 116
Maloney South Lease ... 53
Mararoa Lease ... 55, 116
Mararoa Battery ... 57
Mararoa East Lease ... 56
Mararoa Extended ... 56
Mararoa Extended North Lease ... 55
Mararoa South Lease ... 56
Marora Junction Lease ... 56
Mary Cater Lease ... 96, 118
Mary Cater Gully ... 22
Mary Cater North Extended Lease ... 122, 129
Mary Cater South-East Extended Lease ... 120
Mary Cater South Extended Lease ... 128
Mary Eileen Lease ... 43, 116
Mawson's Reward Lease ... 35
Mawson, W. ... 10
Maybell Lease ... 10, 130
McCarthy's Lease ... 55
McDonough's Find Lease ... 107
Metamorphic Rocks ... 8, 19, 117
Mia Mia Lease ... 35, 130
Mica ... 6
Mica-diorite ... 19
Midas Lease ... 88
Middleton Lease ... 81, 82
Mignon Lease ... 103
Mildura Lease ... 96, 97, 122
Mildura Block Extended Lease ... 82

Page
Mildura-Norseman Lease ... 37, 67, 123, 124, 126
Mildura No. 4 Lease ... 95
Mineral Flat ... 39, 58, 66, 119, 123
Missfire Lease ... 38, 39
Miss Harriet ... 57
Moir, W. ... 10
Molybdenite ... 130
Montgomery, A. ... 18
Montmorillonite ... 66
Moonlight Lease ... 80, 103
Moonta-Norseman Lease ... 42, 125, 126
Morelli's Gully ... 109
Morning Star Lease ... 61, 62
Morrell Lease ... 109, 111, 129
Mt. Accord ... 98
Mt. Barker ... 75, 116
Mt. Barker Extended No. 2 North Lease ... 74, 76
Mt. Barker No. 3 North Lease ... 74
Mt. Barker No. 4 North Lease ... 74, 76
Mt. Barker No. 5 North Lease ... 74, 124
Mt. Barker No. 6 North Lease ... 74, 124
Mt. Barker Reward Lease ... 76
Mt. Barker Welcome No. 1 North Lease ... 75
Mt. Benson Lease ... 84, 85, 88, 122
Mt. Benson Extended Lease ... 85, 86, 127
Mt. Benson John Bull Lease ... 116
Mt. Benson North Lease ... 84, 125
Mt. Benson No. 1 Extended Lease ... 24, 87, 125
Mt. Benson No. 1 North Lease ... 84
Mt. Benson No. 2 Extended Lease ... 90
Mt. Benson West Lease ... 85, 88
Mt. Deans ... 10
Mt. Gambier Lease ... 107
Mt. Kirk Lease ... 94, 116
Mt. Norcott ... 120, 121
Mt. Rugged ... 129
Mt. Woolyenyer ... 93
Murray Channel Lease ... 75

Narrooorte Gully ... 35, 102
Narracoorte Lease ... 102, 103, 117, 129
Nellie May Lease ... 76, 77, 116, 121
Never Despair Lease ... 53, 54
Never Mind Lease ... 60
New Chum Lease ... 100, 101
New Find Quartz Claim ... 59
New North Mary Lease ... 111
New Ophir Lease ... 70
Newtonite ... 66
New Year's Gift Lease ... 108
New Zealand Lease ... 87
Nil Desperandum Lease ... 75
Noganyer Soak ... 34, 130
Norite ... 6, 7, 19, 24, 119, 121
Norseman Lease ... 63, 64, 116
Norseman Central Lease ... 82
Norseman Empress Lease ... 94
Norseman Gold Mines, Ltd. ... 68, 69
Norseman Hill ... 37

Page
Norseman-Lake View Lease ... 120
Norseman No. 1 North Lease ... 25, 62, 63, 122, 123, 125
Norseman No. 1 North Block West Lease ... 62
Norseman No. 1 South Lease ... 64
Norseman No. 1 South Block Claim ... 65
Norseman Proprietary Lease ... 127, 128
Norseman Reward Lease ... 64
Norseman Rose Lease ... 101, 117
Norseman South Bonanza Lease ... 72, 73
Norseman Star North Lease ... 100, 127
Norseman Star South Lease ... 100, 103
Norseman West Lease ... 63
Norse Queen Lease ... 93
North Benson Lease ... 84
Northern Ajax Lease ... 130
Northern Star Lease ... 25, 60, 61, 62, 116, 123
North Norcott Lease ... 7
No. 1 North Norseman Lease ... 55
No. 1 St. Agnes Extended Lease ... 71

Obsidianites ... 22, 23
O.K. East Lease ... 84
O.K. Extended Lease ... 84
O.K. Lease ... 84, 116, 123
Old Saxon-Norseman South Lease ... 70
Opaline Quartz ... 123
Opawa Lease ... 128
Ophir Lease ... 69, 116
Oriental Block Lease ... 109
Oriental Lease ... 109, 117
Oriental No. 1 North Lease ... 109
Oriental No. 1 North Block Lease ... 110
Oriental South Extended Lease ... 110
Oversight Lease ... 85, 116

Palæozoic Age ... 7
Palparaia-Norseman Lease ... 70
Parkinson, J. ... 17
Pekin Lease ... 81
Perseverance Lease ... 110, 123
Pine West Lease ... 108
Pirie West Lease ... 108
Pisolitic Kaolin ... 120
Pluto No. 2 North Lease ... 129
Porphyry ... 119
Pot Luck Lease ... 77, 78
Pot Luck No. 1 North Lease ... 77
Pot Luck Extended Lease ... 77
Pride of Scotland Lease ... 127
Primrose Lease ... 40, 41
Prince of the West Lease ... 49, 50
Princess Royal Lease { 25, 27, 32, 37, 43, 44, 49, 116, 118, 121, 122, 123, 124, 126, 127, 128
Princess Royal Central Lease ... 44, 123
Princess Royal Deep Lead ... 18, 36, 120
Princess Royal Extended Lease ... 128
Princess Royal North Lease ... 44, 47, 49, 126, 128
Princess Royal North G.M. Co. ... 40

Page
Princess Royal No. 1 South Lease ... 123, 128
Princess Royal South Lease ... 49, 126
Princess Royal South Extended Lease ... 30, 32, 122, 123, 125, 128
Princess Royal South G.M. Co. ... 48
Princess Royal Sovereign Lease ... 43
Princess Royal Township ... 7, 13, 38
Priscilla Lease ... 64

Quartz Claim 103 ... 116
Quartz Porphyry ... 6, 19, 25, 26, 27, 28, 124
Queen Alexandra Lease ... 99, 100, 123
Queen of the West Lease ... 7, 95, 96, 117, 129
Queen of the West North Lease ... 95

Raggedy Gully ... 109
Record Lease ... 37, 59, 116, 122
Recoupe Lease ... 89, 90, 116
Recovery Lease ... 89, 90
Red, White, and Blue Lease ... 103
Reefton Lease ... 101
Rescue Lease ... 40, 41
Rienza Lease ... 43
Rising Sun Lease ... 87, 90, 91, 127
Rising Sun No. 1 Lease ... 54
Rock Analyses ... 119
Royal Prince Lease ... 124
Royal Standard Lease ... 69
Royal Standard Norseman Lease ... 69

St. Agnes Lease ... 71
St. Agnes and Norseman Junction Lease ... 73
St. Agnes Block Lease ... 71
St. Agnes Gold Reefs Lease ... 72
St. Agnes No. 1 North Lease ... 80
St. Agnes No. 2 North Lease ... 79
St. Agnes South No. 1 Lease ... 71
St. Alban's Lease ... 105, 117, 127
St. Alban's No. 1 South Lease ... 106
St. Alban's West Lease ... 107
St. Just Lease ... 71
St. Patrick Lease ... 25, 57, 58, 116, 122
St. Patrick East Lease ... 60
St. Vincent Lease ... 84
Salt Lakes ... 17, 20
Salvado's Gully ... 35, 109
Sawpit Gully ... 108, 109
Scandinavian Lease ... 61, 62
Scheelite ... 37, 59
Selenite ... 20
Silicified Wood ... 120
Simpson, E. S. ... 21, 118, 119
Sovereign Lease ... 70
Spirit of the West Lease ... 82
Star Lease ... 34, 103, 105, 121
Star of Erin Lease ... 30, 83, 116
Star South Lease ... 103
Stella May Lease ... 111, 112, 117, 129

Page

Stennett, T. ... 10
Subsidy Lease ... 40
Sudden Norseman Lease ... 60, 61, 127
Sunbeam Lease ... 31, 126, 127
Surprise Lease ... 78
Sussex Lease ... 70
Sydney-Norseman Lease ... 67, 122, 123

Tapio Lease ... 129
Tarpeena Lease ... 102, 103, 129
Taumutu Lease ... 72
Thames Lease ... 54
Thames No. 2 Lease ... 54
Three Colonies Lease ... 38, 40, 116, 126, 128
Three Colonies Extended ... 41
Three Colonies G.M. Co. ... 39
Three Kingdoms Lease ... 53, 54
Three Stars Lease ... 89, 90
Thule Lease ... 51
Tommy Atkins Lease ... 50, 51
Transvaal Lease ... 129
Travertine ... 19, 120
Trig. Hill B 23 ... 7
True Blue Lease ... 79
Trump Card Lease ... 109, 111
Try Again Lease ... 91, 92
Two Hills Quartz Claim ... 57
Two Japs Lease ... 103
Two Williams Lease ... 53, 54

Union Lease ... 92, 116
Union Jack Lease ... 78, 92, 124
United Miners' Lease ... 101, 102, 106, 117
United Scotchman Lease ... 69

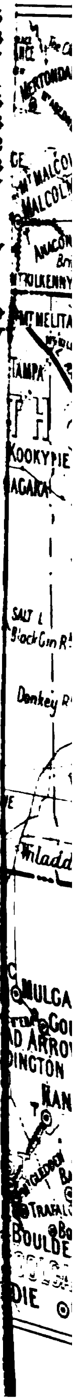
Vale Lease ... 105, 129
Vale North Lease ... 104
Valkyrie Lease ... 25, 27, 37, 71, 72, 116, 122, 124, 126, 127
Valkyrie Consolidated Lease ... 72
Valkyrie Extended Lease ... 71, 128
Valkyrie North Lease ... 71
Valkyrie South Lease ... 72
Valkyrie West Lease ... 71
Venture Lease ... 51, 116
Victoria Norseman Lease ... 56
Viking Lease ... 25, 37, 68
Viking-Norseman Lease ... 67, 121
Viking South Lease ... 71
Virginia Lease ... 93, 116

Waipukeran Lease ... 87
Water ... 14, 15, 118
Water Analyses ... 118
Waterloo Lease ... 127
Welcome Lease ... 95, 99, 100, 117, 127, 128
Welcome Stranger Lease ... 122, 128, 129

Page
West All Nations Lease 55
Westralia Long Tunnel Lease 106
Wheel Lease 100, 101, 117
Wheel North Lease 101
Whiteman Lease 95
Wilgena Quartz Claim 93, 116
Windlas Gully 22
Woodward, H. P. 10, 15, 18
Woolyeenyer 127

Yatala Lease 57

Ziegler's Find Lease 26, 107, 108, 109, 117, 120, 129
Zimmerman Lease 57



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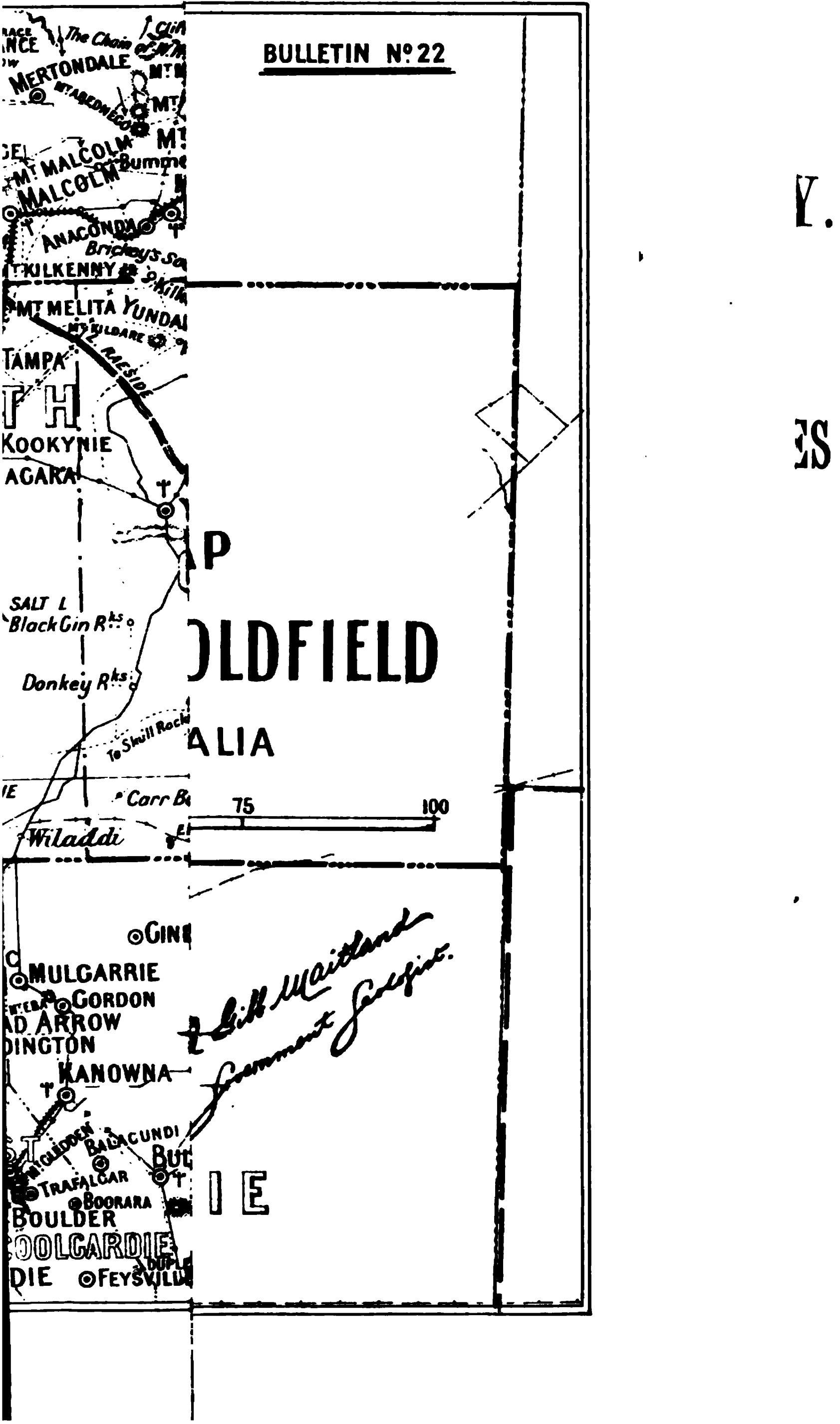

1906.

WESTERN AUSTRALIA.

GEOLOGICAL SURVEY.

BULLETIN No. 22.

THE
AURIFEROUS DEPOSITS AND MINES
OF
MENZIES,
NORTH COOLGARDIE GOLDFIELD,

BY

HARRY P. WOODWARD,
Assistant Government Geologist.

Issued under the authority of the Hon. H. Gregory, M.L.A.,
Minister for Mines.

WITH TWO MAPS AND SIX PLATES OF SECTIONS.

PERTH:
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1906.

TABLE OF CONTENTS.

PAGE

Prefatory Note ... 5

Introduction and General ... 9

PART I.—GENERAL GEOLOGY ... 11

Section I.—Topography ... 11

„ II.—Water Supply ... 11

„ III.—Descriptive Geology ... 12

PART II.—ECONOMIC GEOLOGY ... 19

Section I.—General ... 19

„ II.—The Ore Deposits and Mines ... 21

„ III.—Conclusion ... 74

APPENDIX I.

Synoptical Table showing the Yield of the Leases at Menzies up to 1906 ... 76

APPENDIX II.

List of Specimens in the Geological Survey Museum from the Menzies District ... 82

Index to Names of Places, Mines, Reefs, etc. ... 87

MAPS.

1. Locality Map ... *Frontispiece.*

2. Geological Map of the Menzies District; scale, 40 chains to the inch ... *At the end.*

PLATES.

To face Page

I.—General Plan of the Underground Workings of the Menzies Group; scale, 6 chains to the inch ... 21

II.—Longitudinal and Cross Sections of the Crusoe Reef; scale, 100 feet to the inch ... 30

III.—Longitudinal Section of the Queensland Menzies Reef; scale, 100 feet to the inch ... 32

IV.—Longitudinal and Cross Sections of the Friday Reef; scale, 100 feet to the inch ... 37

V.—Longitudinal and Cross Sections of the Shenton Reef; scale, 100 feet to the inch ... 41

VI.—Longitudinal and Cross Sections and Plan of the Consolidated Reef; scale, 100 feet to the inch ... 63

PHOTOGRAPHS.

PAGE
1. Laterite Hill, near South-West corner of the Water Reserve ... 13
2. Sericite Schist Outcrop, East of the Emu Lease 15
3. Sericite Schist Outcrop, South of Springfield 17
4. Quartzite Outcrop, ½-mile East of Springfield 19

PREFATORY NOTE.

THIS report upon the Auriferous Deposits and Mines of Menzies, by Mr. H. P. Woodward, forms another of the series designed to treat of the different mining centres of the State.

The geological work was based upon the topographical map prepared by Mr. W. D. Campbell in the year 1899. The existence of this map greatly facilitated Mr. Woodward's work, and it is much to be regretted that it has not hitherto been found possible to have the necessary topographical work completed and available before the geological surveys of important mining centres are undertaken. The preparation of the topographical map of Menzies involved a good deal of labour, necessitating the fixing of all shafts, etc., in addition to running contour lines 10 feet apart in altitude; the survey was carried out with a four-inch tacheometer, and as a check a few measurements were made with a chain. In order to preserve continuous contour lines, the survey was carried a little further than would otherwise have been the case.

The area embraced by Mr. Woodward's work covers about 50 square miles, and includes the productive area of the district so far as at present understood. The field work, upon which Mr. Woodward's geological and mining work is based, was commenced in May and concluded on the 20th of October, 1905, but owing to the necessity for him remaining in touch with the Perth office during my absence in the North-West, and in paying short visits to different portions of the State for specially urgent purposes, the Menzies survey could not be carried out continuously.

In its essential geological features, Menzies consists of a complex of basic rocks, through which have been intruded a series of acidic dykes, which in all probability emanated from the large granitic mass which forms the higher ground in the vicinity of Springfield, near the eastern border of the map.

The ubiquitous cover of superficial deposits has rendered geological mapping somewhat difficult, but so far as possible the different rock masses and associated ore deposits have been delineated on the geological map with such a degree of accuracy as the scale of the field plans would admit.

The basic crystalline rocks of Menzies are of considerable importance, as they are everywhere genetically connected with the auriferous quartz reefs of the district; they consist for the most part of amphibolite and diorite, and their derivatives: serpentine, chlorite, and hornblende schists. Many of the more or less foliated or quasi-schistose basic rocks, when followed down to about 100 feet or so below the surface, gradually give place to massive greenstones, which, however, when exposed to the weather, rapidly become fissile and split readily along cleavages planes. This dormant foliation has been proved to exist to the greatest depths yet attained on the field, viz., 800 feet.

The acidic rocks only occupy a relatively small area of the surface in the vicinity of Springfield, though their existence beneath the superficial cover has been proved in wells and quarries to the north and west. They consist chiefly of gneiss, mica schist, sericite schist; and, as is the case with the basic rocks, the schistose character seems to be lost at a variable depth below the surface. There seem good reasons for believing that this mass consists of a porphyritic granite, which owes its present condition to crushing and hydration. A portion of the field is traversed by numerous acidic dykes, some of which are of considerable horizontal extent; they are generally represented by sericite schists and allied rocks, though transitions from such to porphyritic granite have been noticed.

The quartz reefs, which are confined to the greenstones, are of various types and of somewhat different characters. Several large banded quartz reefs, approaching quartzite in appearance, occur in certain localities; they are, however, of no extent, nor are they of any economic importance.

Some very ferruginous lodes which, below water-level often pass into marcasite, are met with, and can be traced for considerable distances; whilst these deposits have proved to be auriferous, they have invariably been found to be of so low a grade as to be unworkable.

Most of the gold from Menzies has been obtained from segregation reefs, which have an irregular lenticular habit. One of the longest of these is 1,600 feet, though with the exception of those in the few larger mines, these segregation reefs do not attain any great longitudinal extent, but form a series of small but rich parallel veins.

One or two fissure-veins occur in the field, but the comparative poverty of their gold contents is more than compensated for by their extent and the probabilities of continuity in depth.

Every available mine on the field was visited by Mr. Woodward during the course of his work, but many of the larger properties were shut down and inaccessible. Full and detailed descriptions of the mines, accompanied by mining plans, without which the text would be wellnigh unintelligible, are given *in extenso* in the report.

Statistics of the production of the district are attached to the descriptive portions, and in the form in which they are represented the figures give as complete a record of the gold yield of the various deposits of Menzies as is possible. These demonstrate that from the area embraced by the Geological Map of Menzies there have been produced 403,787·71 fine ounces of gold, derived from the milling of 348,967·40 tons of quartz, or at the rate of 1·15 fine ounces per ton.

The deposits so far opened up have not been, below the depth of 300 feet, as satisfactory in regard to both quantity and quality of the ore as in the higher levels. Although many of the larger ore deposits appear to have been virtually worked out, there seems every reason to believe that other deposits of a somewhat similar nature to the smaller veins already opened up in many of the old workings may be reasonably expected to be discovered by judicious exploration, and may prove possibly of equal value.

The report and accompanying maps were, on being submitted to the Hon. the Minister for Mines, ordered to be printed for public information.

The index to names, places, mines, reefs, etc., occurring in the report has been prepared by Mr. P. J. Atkins, Clerk to the Geological Survey.

A. GIBB MAITLAND,
Government Geologist.

Geological Survey Office,
Perth, 12th April, 1906.

The Auriferous Deposits and Mines of Menzies,

NORTH COOLGARDIE GOLDFIELD.

Introduction.

This report is accompanied by a geological and topographical map of the district around the town of Menzies, also a plan showing the underground workings, lodes, cross-courses, etc., of the principal mines, and has been divided into sections under the following heads:—

I. *General.*—A description of the position of the area under review, with its discovery, history, and annual production of gold from 1896 to 1905.

II. *Topography.*—A short general description of the physical features of the district.

III. *Water Supply.*—A description of the sources from which it is obtained, and its character, with a rainfall table for the preceding nine years.

IV. *Descriptive Geology.*—A short description of the nature of the various rocks, dykes, reefs, and faults.

V. *Economic Geology.*—A short description of the various mines, with the quantity of gold yielded by each lease in the district since its discovery.

VI. *Conclusion.*

Appendix I.—Synoptical Table showing the yield of the Leases at Menzies up to the end of 1905.

Appendix II.—List of Rocks in the Geological Survey Museum, collected in the Menzies District.

General.

Menzies is situated in the North Coolgardie Goldfield, longitude 121 degrees, S. lat. 29 degrees 40 minutes, at an altitude of 1,403 feet above the sea-level, being connected with Perth and Fremantle by a railway line 467 miles in length *via* Kalgoorlie.

In a Handbook of the North Coolgardie Goldfield, compiled by Mr. J. McIntyre and published by the *Herald*, at Menzies, in 1899, it is stated:—

"L. R. Menzies, after whom the district is named, and J. McDonald (representatives of a Perth syndicate) applied on the 1st

October, 1894, for the first lease in what is now known as the Menzies district. They were not, however, the first prospectors. A well-equipped party came from the 90-mile (Goongarrie) in August of that year, consisting of J. Brown, C. Kirby, and C. Jackman, and had, to a certain extent, developed a show about two miles south of the lease Messrs. Menzies and McDonald applied for. It did not turn out as expected, and the lease was not at that time applied for, though afterwards it was taken up and called the 'Pioneer' (Lady Harriet). The lease, however, which Menzies obtained was the world-famed 'Lady Shenton,' the leading mine of the district."

Owing to the richness of the early discoveries, this district rapidly attracted considerable attention in the mining world, with the result that numerous companies were floated and large areas applied for as leases. Unfortunately, however, the rich properties were limited, and, more unfortunately still, the lodes in these, after yielding a considerable quantity of gold, have, with a few exceptions, decreased so considerably in size and richness in their lower levels that work has been practically suspended.

Up to the end of the year 1905 over 400,000ozs. of gold were obtained from this district, of which total over seven-eighths were produced by seven Companies, the properties of five of which have now practically ceased to be productive. In spite of this fact it is most satisfactory to note that the gold returns from this district have not fallen off as considerably as might have been expected, this being due to the large number of small rich shows that have been developed by working miners since the establishment of a State Battery.

The following is a statement of the gold yield from this district, from its inception up to the end of 1905, as reported to the Mines Department:—

*Table showing the Annual Yield of Gold from the Menzies District.**

Year.	Ozs. crushed.	Gold therefrom.	Rate per ton.
	tons.	fine ounces.	ozs.
Prior to 1897	8,472	17,135·24	2·02
1897	26,181·35	45,979·54	1·75
1898	24,114·00	45,691·80	1·89
1899	38,283·05	50,076·01	1·30
1900	34,066·75	39,720·09	1·16
1901	38,202·25	43,831·80	1·14
1902	43,945·50	47,080·63	1·07
1903	51,782·35	47,929·20	·92
1904	41,984·85	31,146·12	·74
1905	41,935·30	35·197·28	·84
Total	**348,967·40**	**403,787·71**	**1·15**

---

* This table includes only the returns from those leases which are embraced by the area of the Geological Map.

PART I.—General Geology.

Section I.—Topography.

The area under review surrounds the township of Menzies, covering about 50 square miles, the survey of which was carried out by Mr. W. D. Campbell, Assoc.M.Inst.C.E., F.G.S., Topographical Surveyor, and now Assistant Geologist; and it is upon the plan which he prepared, and which was printed in 1899, that the present geological lines have been laid down.

The tract covered by the plan can best be described as an elevated hilly region surrounded by alluvial plains, which latter gradually fall towards lakes.

The whole was originally thickly covered with mulga scrub with here and there stunted gum trees, but since mining operations started the timber-cutters have made very considerable inroads into it, in fact those portions near the town and mines have been absolutely denuded of timber.

The highest hill is Mt. Misery, 1,660 feet above sea-level, or 330 feet above the alluvial flats; it is situated near the centre of a rough range of hills which run in a north-west direction upon the eastern side of the district. These hills present a steep face to the eastward but are flanked by a belt of broken elevated country to the westward, which gradually descends towards the flats which lie to the north, south, and west.

Except in the hilly regions, well-defined watercourses are of rare occurrence owing to the very gradual fall and the pervious nature of the surface; in consequence, after heavy rain, like thunderstorms, large tracts of the alluvial flats may often be covered for a short time by a thin sheet of water, whilst after light rains no water runs, but the whole becomes so boggy as to be impassable.

Section II.—Water Supply.

Owing to the facts mentioned above and the generally light and very uncertain character of the rainfall this area is not adapted to the conservation of surface water, whilst the subterranean supply is very limited; the area over which that of a potable quality can be obtained is small and the supply extremely limited.

Although the united supply from the above two sources has very frequently proved inadequate for the domestic requirements of the residents the demand for an extra supply is of too intermittent a character to warrant the erection of a condensing plant, therefore water is now hauled by the railway from the Goldfields Water Supply reservoir at Kalgoorlie, a distance of 80 miles, which materially increases the cost of living.

In the upper levels of the mines a small supply of salt water is often encountered in sinking but this is practically lost in depth, therefore milling plants, etc., are mainly dependent upon a supply of salt water pumped a considerable distance from a low-lying area to the westward of Menzies, which renders treatment costly and precludes the possibility of the profitable working of low-grade deposits. The underground fresh water supplies are confined mostly to alluvial basins upon the eastern side of the district, and being entirely dependent upon the rainfall the supply varies considerably and is limited.

Annual Rainfall at Menzies.

Year.	Inches.	Days upon which rain fell.
1897	4·52	38
1898	4·45	28
1899	4·86	32
1900	12·17	58
1901	7·17	30
1902	11·26	34
1903	15·24	53
1904	9·70	55
1905	6·81	29

Section III.—Descriptive Geology.

In order to follow this description it will be necessary to refer to the Geological Map of the district, upon which the boundaries of the various formations have been carefully laid down.

By reference to the Explanation of the Colours and Signs upon the map it will be seen that the rocks, which are represented by distinguishing colours and signs, have been classed under the following headings:—1st, the Recent, which is subdivided into Alluvium consisting of clay, loam, sand, and gravel of the flats and creek beds, and Laterites consisting of brown hematite (ironstone), ferruginous claystone, and conglomerate (cement) capping the hills and ridges. 2nd, the Crystalline and Altered Rocks, which have been subdivided into Basic consisting of serpentine and chloritic schists, amphibolites, aphanatic diorite, and other hornblende and allied rocks, and the Acid consisting of sericite, mica schist, granite, and quartzite. 3rd, the Igneous Rocks which occur as dykes of felsite, porphyry, and granite.

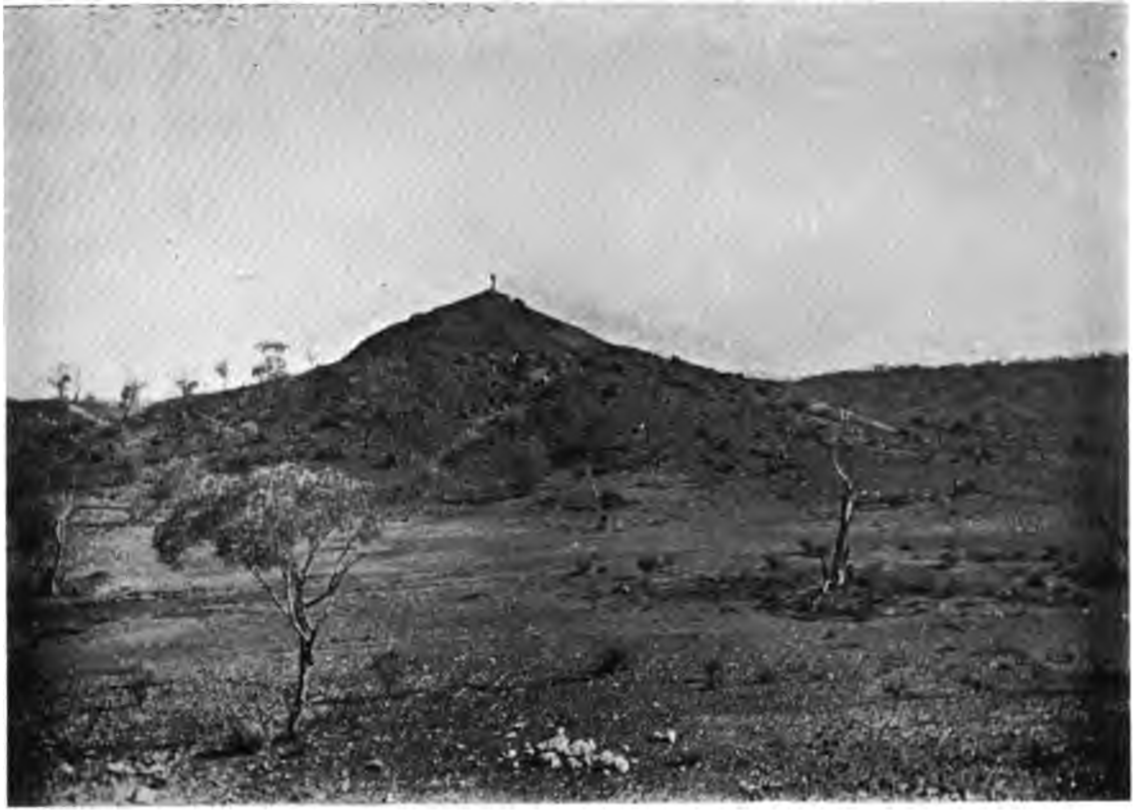

Photo., H. P. WOODWARD. Govt. Photo. Litho.

Laterite Hill, near South-West corner of the Water Reserve.

The two general cross-sections at the bottom of the map will make clear the fact that although a very considerable area is mapped as alluvium this is often of little thickness; in fact near the Lady Shenton mine and at several other points along the auriferous belt it barely covers the weathered schists, whilst reefs often outcrop through it. It is strictly speaking a superficial deposit resulting directly from the weathering of the schists *in situ*, but since it masks the underlying rocks, dykes, etc., and merges imperceptibly into the true alluvium, it has been included under that head.

In both sections the portions of the various rocks near the surface in the zone of hydration have been ruled to indicate their foliated nature, whilst the rocks beneath are coloured to represent diorite and granite respectively as their probable anhydrous character.

Recent Superficial Deposits.

The greater portion of the surface of the area mapped is covered by shallow superficial deposits, which have been classed under two heads, viz.: Alluvium and Laterites.

The Alluvium covers all the plains, flats, and valleys, and consists of soil, clay, loam, sand, gravel, and cement (calcareous conglomerate), varying in thickness from a few inches to many feet, their surface being often covered with fragments of ironstone, quartz, or rock which when auriferous are worked as dryblowing patches and deep leads.

The term alluvium has been adopted to cover these recent surface accumulations as a matter of convenience, but it is hardly accurate nomenclature since only those portions which follow the drainage channels appear to have been deposited by the action of running water, whilst the balance, which is by far the most considerable, has evidently been formed from the gradual disintegration of the rocks by meteoric influences, but for obvious reasons it has been found impossible to distinguish it from the genuine alluvium.

The Laterites are found capping many of the hills and ridges, being apparently the remnants of an extensive formation which covered the entire western portion of the area, the softer portions of which have gradually yielded to atmospheric influences but still leave ample evidence of their previous existence in the ironstone fragments which cover the flats.

These cappings are composed of ironstone, which however varies very greatly in composition from almost pure limonite (hydrated oxide of iron or brown hematite) **[1177-8, 1203-4, 6317]** to earthy ochres and ferruginous clays.

These ironstones, although presenting a dark chocolate-coloured polished exterior, when broken are found to be of a very porous nature, which renders them very susceptible to atmospheric influences, with the result that the more or less horizontal hard crust has been riddled with pipes and caverns by meteoric water, which, causing it to collapse from time to time, have so broken these cappings that they mostly present the appearance of an aggregate of rough masses.

Beneath these cappings are soft beds of a more or less earthy nature, which when followed down merge imperceptibly into the oxidised rock beneath; this portion of the formation is also a source of weakness to the ironstone, since animals and reptiles burrowing beneath the harder crust cause falls of the roof through leaving insufficient support.

Laterites are the result of subaerial decomposition of the rocks *in situ*, due to hydration and oxidation in a practically rainless and tropical country, consequently their composition is liable to vary considerably even over a small area, it being governed by the nature of the underlying rocks.

That ferruginous laterite cappings are most commonly met with is due to the fact that the amphibolite series from which they were derived are largely developed upon the goldfields and are rich in iron, whilst further deposits of this nature were able to resist recent denuding influences better than the softer deposits of a purely magnesian, calcareous, and aluminous character, and in consequence they not only remained themselves but also protected the underlying rocks, with the result that they now appear as ridges or hills since the adjoining unprotected country has been denuded. They are of little economic value upon this area, for, with the single exception of that upon the Crusoe hill a small but rich deposit of gold was discovered associated with one of these earthy ferruginous beds; in this deposit the gold was found to be of an entirely different character and of a much higher value than that obtained even from the oxidised zone in the mines, whilst subsequent trenching and cross-cutting beneath it failed to prove the presence of any auriferous body in the vicinity. The inference therefore is that this deposit results from the concentration of gold carried in small quantities in the country rock (this being a common feature of this belt), during which process the silver and baser metals were removed and the fine particles of gold united.

The Crystalline Series.

These rocks not only outcrop over a considerable portion of this area but also underlie directly all the superficial deposits: great interest centres in them as they form the matrix of the auriferous quartz bodies.

They have been divided into two groups upon the map, viz.: (*a*) the Basic, which consists largely of hornblende and minerals resulting from its hydration, such as serpentine, talc, and chlorite; and (*b*) the acid, in which silica predominates.

The basic series are traversed by numerous felsite and granite dykes, which were apparently intruded prior to the formation of the quartz-veins since these latter intersect both the basic and acidic ›cks, without the remotest partiality.

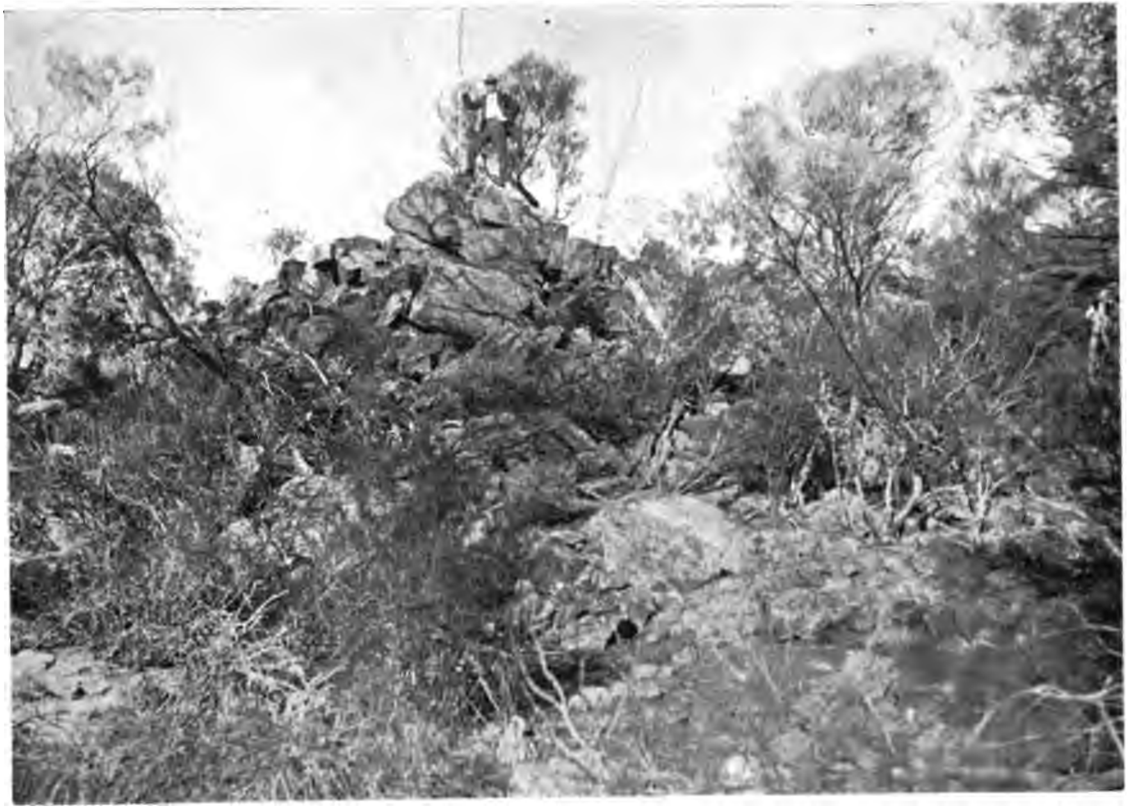

Photo., H. P. Woodward.

Govt. Photo. Litho.

Sericite-schist Outcrop. East of the Emu Lease.

Of these rocks the basic cover by far the greater extent, presenting generally at the surface a schistose character [**750, 752, 754, 1047**] merging imperceptibly into massive crystalline amphibolites [**801, 1174, 1192, 1988**], which usually form rough ridges or bosses, but are clearly not dykes, since all attempts to define their boundaries failed utterly.

When these rocks are sunk upon, as in mining, their character quickly changes, the schistose structure giving place below the water-level (about 100 feet) to a massive aphanitic jointed diorite in which no cleavage planes are visible [**6371, 6312, 6331**]. It breaks in masses more or less cubical exhibiting absolutely no schistose structure to the naked eye, but on exposure to the action of the weather dormant cleavage planes rapidly develope, when it becomes fissile and splits in a shale-like manner when struck with a hammer. To what depth this dormant fissility actually extends it is impossible in the present condition of our knowledge to determine, but it is known to exist in a slight degree at the greatest depths attained at present in any of the mines, viz., about 800 feet vertical.

The schistosity within this area has a general strike to the north-westward, with an underlay of about 45 degrees to the westward; but in the Kensington belt the direction, for a distance of one mile, is found to have changed to the north-eastward, whilst the dip changes from north-west to south-east.

At the Goodenough, which lies about half a mile to the north of the northern end of the Kensington belt, a sudden change has taken place for a short distance, the cleavage planes striking east and west and dipping south.

The Acid group is only developed at the surface to any extent in one hill mass about two miles in length, which runs in a south-easterly direction from Jowett's Well, situated a little south of Mt. Misery; but they also have been proved to exist in wells and quarries beneath the alluvial flats to the eastward and northward [**6339, 6318**].

Where these rocks outcrop they generally consist of gneiss, mica schist, sericite schist, and quartzite [**6321, 6365, 6320**], but these characters are, as in the basic series, lost at a moderate depth below the surface, mica schist giving place to gneiss, and sericite schist to sericite slate; however, it is impossible to study what changes take place in these rocks below the water-level as they have not yet been sunk upon, but to judge from the changes that have taken place in the dyke rocks (as will be gone into later on) it is highly probable that this entire mass is an intrusion of porphyritic granite, altered near the surface by hydration and crushing.

At several points on the alluvial flats to the eastward of Mt. Misery, weathered schists are met with in the wheel-ruts or in trenches, whilst granitic rocks form the country at the Federal Group, which runs in a north-easterly direction, a little to the north-westward of the Kurrajong Lease, 3482. Along the railway line and the Niagara Road granite has been met with in sinking wells, also in some quarries where weathered granite has been worked a little to the north-eastward of the town.

The basic rocks are intersected by numerous dykes, which are most largely developed at the surface along a belt which extends in a north-westerly direction from the north end of the outcrop of the acid rocks near Jowett's Well, passing the south end of the Kensington belt, and continuing to the northward of the water catchment area, gradually concentrating to the north-east corner of the town by the Hospital Reserve. A few scattered acidic dykes are also visible around Mt. Misery and at one or two other points upon this area; but although they do not outcrop along the auriferous belt owing to the alluvial covering, they are constantly met with in sinking. Such of the dykes as outcrop have been mapped with considerable care, under the supposition that they might have played an important part in the formation and enrichment of the reefs; this, however, upon careful examination of these bodies in the mines situated upon the auriferous belt, proved not to be the case, since it became evident at once that they were intruded prior to the deposition of the quartz veins, which are found to intersect them indiscriminately with the hornblende rocks.

The dykes where they outcrop generally present a felsitic and often silicious appearance, splitting into flags, which have been quarried for pitching purposes upon the northern side of the water reserve [**6367-70**], but at other points they have passed into very friable sericite schists. This latter characteristic is generally met with upon the auriferous belt immediately below the alluvium, but these, like the other rocks, rapidly change in depth.

No examination of these rocks could be made below the surface, except where mining operations have been carried on, but to judge from the general surface character they are apparently of one class, their different nature at the surface being due to local influences whilst metamorphism was taking place.

These dykes, where met with along the auriferous belt, as mentioned above, are generally represented by sericite schist, with here and there small patches of mica representing weathered granite. This character sometimes extends throughout the entire depth of the oxidised zone, or it may pass into weathered gneiss, thence into solid gneiss, or crushed granite, which at greater depths, when struck by bores, proves to be a porphyritic granite with small crystals of black mica [**6340-4, 6337, 6364, 6371**].

A complete series, illustrating this interesting transition from soft-weathered sericite schist into porphyritic granite, have been collected [**6332-6**].

At the north-west corner of this area two dykes of albite granite outcrop, which have been opened up evidently in the hope of their proving auriferous [**6318**].

The basic rocks also contain sparry veins of dolomite below the oxidised zone, whilst above it these are represented by creamy-

PHOTO. 3.

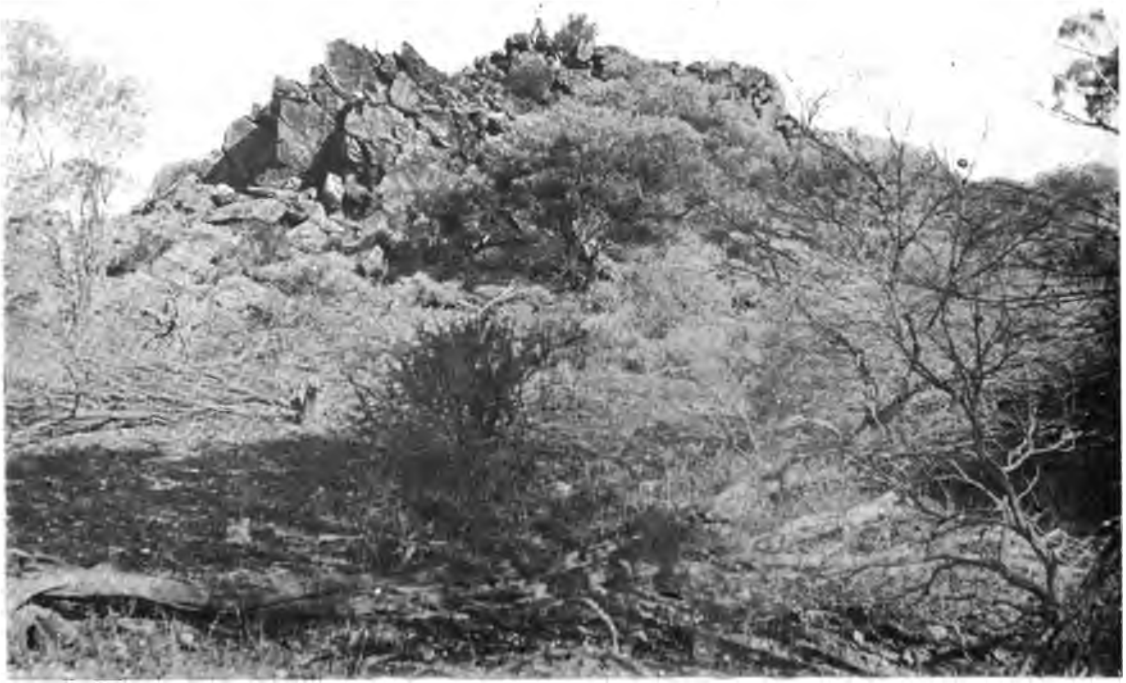

Photo., H. P. WOODWARD.

Sericite-schist Outcrop, South of Springfield

Govt. Photo. Litho.

coloured veins of magnesian limestone [**6322, 6315-6**], which are particularly numerous amongst the serpentine schists. These rocks also contain veins of actinolite and a little inferior asbestos in places [**6323, 6325**].

Quartz Veins.

The quartz reefs may be first divided into three classes, viz., auriferous, metalliferous, and barren reefs, of which the auriferous may be still further divided into (*a*) fissure veins and (*b*) irregular segregations forming composite lodes, and the barren into (*c*) irregular buck reefs and (*d*) fissure cross-courses.

Large barren buck reefs, which often approach a quartzite in character [**785, 1189, 1202**], having no definite course and of no considerable length of outcrop, are met with at several points upon this area; they are conspicuous, as they either form bold ridges or fragments and from their disintegration cover considerable areas of the surface.

The cross-courses are barren quartz bodies, formed along fault lines, which intersect the auriferous veins; they have a more or less east and west course and underlay mostly to the north, but are not as a rule of great longitudinal extent.

There are also a series of ferruginous lodes, which at the surface are oxidised, but near and below the water-level they pass into pyrites, mostly marcasite, containing a little gold, which, however, is in too small a quantity to cover the cost of working. These lodes have generally a more or less north-west course, and can often be traced for a considerable distance at the surface. One of these follows the main belt of dykes upon the north-east side, starting from a little east of Merry's Well, passing by the Maranora and Kensington mines to the south westward, and so on in a north-westerly direction for about a mile. Another large lode of this description is met with at the Goodenough mine, but here it does not appear to be of great extent.

Along the auriferous belt, bodies of this description are often met with and are generally known as mineral lodes. They are well-defined and apparently continuous for considerable distances, but are uniformly of very low grade. One very noticeable point with regard to these bodies is that they not only are of little value themselves, but are said as a rule to exercise an impoverishing effect upon the auriferous lodes at any points at which they come in contact.

Composite lodes.—The class of reefs around which the greatest interest centres are those from which the major portion of the gold produced from this district was obtained, and these may be classed as irregular lenticular segregation deposits. They occur either in the form of pipes or a series of lenticular masses; the longest axis, following the cleavage planes of the rock diagonally in a southerly direction, is called the shoot. In the upper levels it is not uncommon to find a series of such veins following parallel planes, but these gradually give out in depth. In the oxidised zone many of these veins were very rich, the gold sometimes being associated with chloride of silver, whilst below the water-level galena is generally met with if the stone is of high grade. The greatest length to which one of these quartz bodies of the pipe-like form has continued to be payable is that worked in the Queensland Menzies mine; it is about 1,600 feet in length; whilst in the Lady Shenton, where the combined ore shoots have a much greater horizontal breadth, the shoots do not exceed 800 feet in length upon the incline; the vertical depth being in the former 660 feet and in the latter a little over 330 feet. With the exception of the few large mines, these veins are not usually of great extent individually, but more commonly consist of a series of small but rich quartz bodies, forming as a whole a lenticular mass, including the enriched decomposed rock called "formation"; but this latter diminishes the value of the stone too greatly to be profitably worked except by a plant upon the spot, therefore only the quartz is as a rule treated.

Lines of this nature are common throughout this belt, but since the surface is covered by superficial deposits a considerable amount of prospecting is often necessary before they are located. Owing to this, leases are repeatedly abandoned under the supposition that they are worked out, to be taken up later and worked again time after time as further prospecting by other parties revealed the existence of fresh quartz veins. Although other well-defined lenticular quartz bodies may be met with below the point at which the ore-shoot pinched out, it has been found that such bodies, if they do not come into existence either in the oxidised zone or immediately below it, have not been enriched to the extent which renders them payable, whilst the adjoining country rock at many points along this belt has proved to be auriferous.

Fissure-veins are not nearly so common in this district as the segregation veins, but a good example is exhibited in the Consolidated mine, the footwall of which is striated and highly fissile and indurated, indicating considerable movement. The Aspasia lode also shows the same indications. These lodes do not appear to carry so much galena as the segregation veins, neither are they so rich; but this is in a measure compensated for by their greater longitudinal extent of the ore-shoot, and also probable continuity in depth. The pay shoot in these reefs dips in the same direction as the others, viz., in a southerly direction, upon an inclined plane which dips at an angle of about 45 degrees to the south-westward, but they differ in so far that the vein does not of a necessity end at the point where the stone pinches out, but may be met with again further north or south along the fissure.

Faults.

Besides the cross-head joint faults mentioned under cross-courses, which have disturbed the auriferous reefs by throwing them in an easterly or westerly direction, there are a series of faults

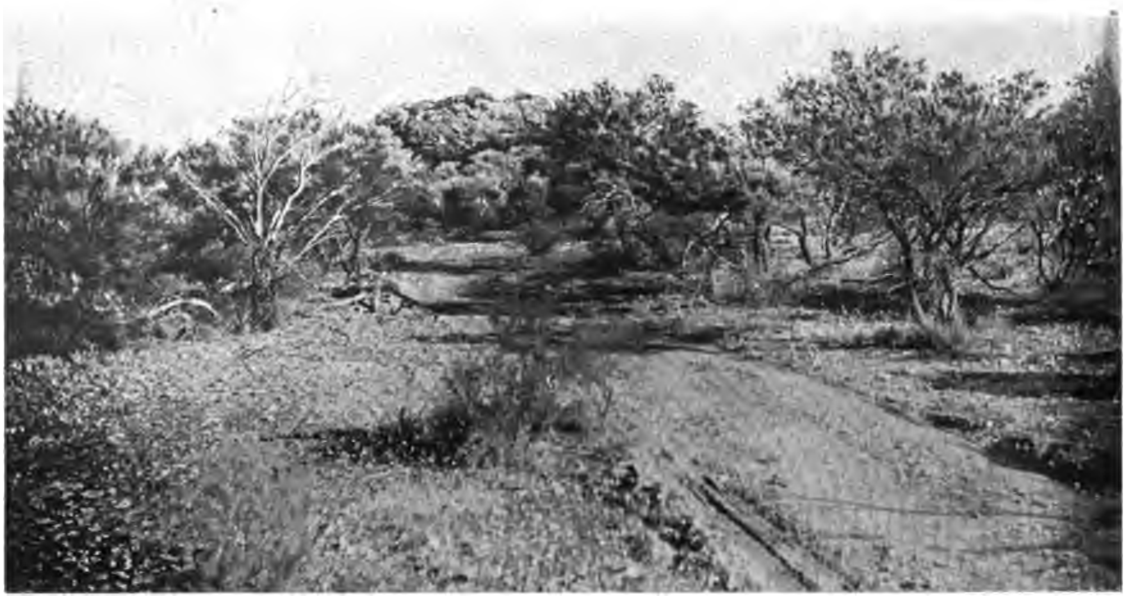

Photo., H. P. Woodward. Govt. Photo. Litho.

Quartzite Outcrop, half mile East of Springfield.

and thrust planes which coincide more or less with the foliation of the rocks, and in consequence are not apparent in the oxidised zone. These faults may form the fissures for lodes such as the Consolidated and Aspasia, where they more nearly coincide with the cleavage planes of the rock, or they may occur as thrust planes, when, although generally adopting the universal strike, they cut the foliation planes at a lower angle. These are possibly up-throw faults of limited extent, due to the intense lateral pressure caused by the expansion of the rocks whilst undergoing hydration, in which case they would have existed prior to the formation of the auriferous reefs, which latter sometimes terminate upon them.

PART II.—Economic Geology.

Section I.—General.

In the preparation of this section, which is devoted to a description of the reproductive ore bodies, great difficulties have been experienced owing to the fact that most of the large mines are now inaccessible, whilst, where accessible, timbered levels and worked out stopes (where not mullocked up) afford little information as to the character and size of the lode, since often a considerable quantity of the adjoining enriched rock has been removed with the stone, or the lode may have consisted of a number of small veins which necessitated the removal of the interpolated rock which was crushed or used for filling, according to its value.

To add to this difficulty, little reliable literature exists; whilst plans, in many instances, of underground workings of defunct Companies have been lost or taken away by the owners' representatives, and not lodged with the Government.

Information has therefore been collected from the most reliable sources, such as prospectors, mine managers, etc., who have most kindly done all in their power to assist in the investigations.

In order to give as clear an idea as possible of the nature of the ore deposits and the extent of the work done upon them, working plans, etc., have been reduced and reproduced upon a general map (Plate I.), which will be found of use if followed in conjunction with this section of the report.

The depths of the shafts, etc., have been taken as far as possible from the certified working plans, but, where these were not obtainable, either from official records, information obtained from owner, manager, or personal examination; the latter not being very reliable, since many of the old shafts have been partially filled in or have fallen in. The depths at which water was encountered in sinking, and its character and yield per diem, has necessarily been taken from official and other records, for where shafts have been sunk to a depth below the water-level into the solid country and no further supply is met with, that originally struck often disappears altogether.

The number of tons of stone crushed, with the gold yield therefrom, is taken from the statistics published by the Mines Department, the information being so arranged that no matter how many times a property has changed hands, the total production is given from each individual area.

This area yield must not be confused with the system usually adopted by this Department of adding the totals from an individual reef, no matter how many properties it may pass through, the change of system being found necessary because continuous reefs are almost unknown in this district; in fact, in many instances, the returns from a single property may have been derived from a number of reefs. When tabulated in order to give a grand total, the names of all leases included, represent the same area, or portions of it, and not adjoining properties on the same line.

Recently, this field has been worked largely under Protection Areas in place of leases, the yield from which has not been allocated, but is given under the head of various claims in the total.

In the case of mining companies working several leases and giving bulk returns, where possible an analysis has been obtained from the manager in order that the produce may be credited to the particular locality from which it was derived.

There are two auriferous belts within this area; one, which may be called the main or western belt, starts to the north-westward of the town, at the St. Alban's group, from which it runs in a south-easterly direction, widening out as it approaches the town, through which it passes on the western side, then on, gradually contracting until it reaches the township of Yunndaga (Woolgar), south of which it extends two miles, terminating in the Barunga Brave. This belt, like the lodes themselves, is of a lenticular shape, but the resemblance to the individual ore bodies does not end here, for, on investigation, it is found that the belt does not consist of one main defined line, but of a series lying more or less parallel to each other, crossing this main belt diagonally upon a course rather more westerly. These secondary lines are further found to be constituted of lines of disconnected bodies or bunches, and these latter of aggregates of pipes or lenses of quartz.

The other group, which may be called the Kensington group, strikes in a north-easterly direction upon the western side of Mt. Misery. It is not nearly so long as the main belt, nor has it yielded anything like the quantity of gold. In this group the individual lines are not uniform in their strike and dip, the westward line dipping to the westward, the central lines to the eastward, and the eastern line to the westward, whilst the Kensington at the south, and the Goodenough at the north, strike east and west, dipping south.

Outside these two main belts there are a few scattered leases, but the total yield of the gold from these is inconsiderable.

Section II.—The Ore Deposits and Mines.

St. Alban's Group.—This group of leases, which were originally worked by the Menzies Consolidated Company, is situated upon a low hill of schistose rock that rises above the alluvial flats about three miles north-west of Menzies. Of the St. Alban's lease in 1895, Mr. H. Y. L. Brown, Government Geologist of South Australia, says: "This is a quartz reef which strikes east and west and dips south at an angle of 45 degrees. The gold occurs in quartz."* There are three parallel lines of small reefs, which have been traced for a length of from 50 to 100 feet in an east and west direction in schistose diorite [**805**]. They have been worked by a series of underlay shafts to the water-level, but a vertical shaft has been sunk to a depth of 240 feet, in which a small quantity of salt-water was encountered from 100 to 150 feet. Since the Company abandoned it in 1897 the lease has been continuously worked, but has twice changed hands.

Table showing the Yield of the St. Alban's Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1898 ...	St. Alban's, G.M.L. 4883z	16·00	66·86	4·18			
1899 ...	Do. ,,	154·75	260·08	1·76			
1900 ...	Do. ,,	94·00	200·15	2·12			
1901 ...	Do. ,,	76·00	131·67	1·69			
1902 ...	Do. ,,	61·00	28·38	·47	408·75	687·09	1·70
1903 ...	Do. 5081z	27·00	20·26	·75			
1904 ...	Do. ,,	31·00	60·78	1·96			
1905 ...	Do. ,,	15·00	28·00	1·87	73·00	109·04	1·49
	Total	...	...	...	476·75	796·13	1·67

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* Auriferous Deposits of Western Australia. Adelaide. By Authority, 1896, p. 4.

Resurrection, G.M.L. 4859z.—This lease is situated a few chains to the eastward of the last, the reef, which follows the same course, viz., east and west, has been opened up by a number of shallow underlay shafts upon the dip of the vein, which is to the south in decomposed schistose rock.

Table showing the Yield of the Resurrection Reef.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1897	5·00	5·37	1·07
1898	41·50	17·85	·43
Total	**46·50**	**23·22**	**·50**

The European, G.M.L. 5210z, and **Little Peter**, G.M.L. 5201z, are situated upon a small gravel rise near the Racecourse, about half-way between the St. Alban's and the town. Here some shallow holes have been sunk in the weathered rock, from which on the former 8 tons of stone were raised, which yielded 5·25ozs. of gold, and on the latter 10 tons, which yielded 3·41ozs. About a mile south of the last, at the north of the main belt and upon the north-western side of the town, are two properties now called the **Menzies Proprietary**, G.M.L. 5236z, and the **Dublin Castle**, G.M.L. 5215z, which were originally known as the Little Gem, G.M.L. 3722z, and Selkirk, G.M.L. 2842z, and owned by the Menzies Gold Reefs Proprietary, Ltd., which Company did a considerable amount of prospecting upon them without discovering anything of sufficient size or value to be considered payable. These properties were both taken up by working miners in 1900, and, with the exception of time lost in changing hands, they have been worked ever since.

There are a large number of shallow shafts sunk upon small veins in the oxidised zone, with some driving and crosscutting, the rock being decomposed schist, and the reefs strike upon a north-westerly course and dip to the westward.

Table showing the Yield of the Menzies Proprietary Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1900 ...	Menzies Proprietary, G.M.L. 4953z	20·00	37·66	1·88			
1901 ...	Do. ...	70·25	53·22	·76			
1902 ...	Do. ...	39·00	71·81	1·84	129·25	163·69	1·25
1903 ...	Menzies Proprietary, G.M.L. 5140z	8·00	16·98	2·12			
1904 ...	Do. ...	183·00	120·11	·65			
1905 ...	Do. ...	10·00	8·63	·86	201·00	145·72	·72
1905 ...	Menzies Proprietary, G.M.L. 5236z	128·00	270·15	2·11	128·00	270·15	2·11
	Total	...	...	...	**458·25**	**588·56**	**1·28**

Table showing the Yield of the Dublin Castle Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average Rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1900 ..	Dublin Castle, G.M.L. 4952z	38·00	49·36	1·30			
1901 ...	Do. ...	133·00	311·79	2·34			
1902 .	Do. ...	13·00	37·50	2·88			
1903	Do. ...	72·00	78·37	1·09			
1904 ...	Do. ...	18·00	26·16	1·45	274·00	503·18	1·83
1905 ..	Dublin Castle, G.M.L. 5215z	141·00	230·38	1·63	141·00	230·38	1·63
	Total	...	...	...	415·00	733·56	1·77

A little to the westward of the Dublin Castle are the following old leases, which have been held for short periods only; little work has been done upon them.

Table showing the Yield of the following Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	Menzies Main Reef, G.M.L. 4897z ...	39·00	15·98	·42
1903 ...	Easter Gift, G.M.L. 5095z	23·00	5·66	·24
1904 ...	Ophir, G.M.L. 5186z	17·00	5·92	·35
1904 ...	Witch Hazel, G.M.L. 5154z	21·00	8·82	·42
1904 ...	Ada Ella, G.M.L. 5185	10·00	5·53	·55

Victory North, G.M.L. 5068z.—This lease lies to the south of the last-mentioned group and at the extreme north of the Aspasia or western line of lodes. Upon it a small body of stone, about eight inches wide, which follows the usual north-westerly strike and dip of 45 degrees west, has been opened upon at two points upon the eastern boundary. The northern group of workings consist of three shafts, two upon the underlay of the reef, which are connected, and a vertical shaft, which cut the reef at 150 feet, but which has not yet been connected with the other shafts.

Farther south there are two more shafts on the reef, which are connected at a shallow depth.

Table showing the Yield of the Victory North Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1902 ...	Victory North, G.M.L. 5068z	12·00	12·43	1·03
1903 ...	Do. „	51·00	109·83	2·15
1904 ...	Do. „	70·50	91·87	1·58
1905 ...	Do. „	39·00	60·50	1·55
	Total	172·50	274·63	1·59

Victory, G.M.L. 5066z.—This lease, which is situated immediately south of the last, was worked prior to 1901 by the Menzies Mining and Exploration Corporation as the Helena, G.M.L. 3203z, it was then taken up as the Surprise, G.M.L. 5002z, and in 1902 it became the Victory.

A good many shafts were sunk by the original Company in searching for the northern extension of the Aspasia lode, one being 30 feet, with a crosscut 100 feet both east and west in which a number of small veins were met with, whilst on the Surprise a shaft was sunk 43 feet on the western reef with a drive south 35 feet. The deepest shaft is 130 feet, of which 80 feet are vertical, it then follows a small reef with the usual strike but which dips at an angle of 65 degrees west. All the stone raised comes from the oxidised zone, and at the present time all work is confined to a vein upon the eastern boundary.

Table showing the Yield of the Victory Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1901 ...	Surprise, G.M.L. 5002z	65·00	70·51	1·08			
1902 ...	Do. ,,	58·00	45·73	·79	123·00	116·24	·94
1902 ...	Victory, G.M.L. 5066z	20·00	32·52	1·63			
1903 ...	Do. ,,	46·00	194·29	4·22			
1904 ...	Do. ,,	93·00	162·21	1·74			
1905 ...	Do. ,,	80·00	144·61	1·80	239·00	533·63	2·23
	Total	...	...	...	362·00	649·87	1·79

Menzies Lady Sherry, G.M.L. 2835z.—This mine adjoins upon the south of the Dublin Castle and was first worked from 1896 until 1903 by the Menzies Lady Sherry G.M. Company, N.L., who also owned as block claims to the westward, leases Nos. 3806z and 3914z, both of which were named the Lady Sherry West; also 4069z, the lease then called Brown's. In 1903 the property was sold to the present owners, who now only hold G.M.L. 2835z.

Mr. H. Y. L. Brown says of this property in 1895—"Three quartz reefs were being mined upon here at the time of my visit. In No. 1 shaft I observed a quartz reef dipping westerly at an angle of 45 degrees with red mullocky formation, composed of white kaolin and quartz (decomposed granite). No. 2 shaft is on a quartz reef which dips westerly 45 degrees to 60 degrees. No. 3 shaft is also on a quartz reef which branches into veins below. The quartz contains coarse gold. The country rock in the neighbourhood of these mines is argillaceous talcose and chloritic schists and decomposed diorite, and micaceous slate was observed in one place." [789.]

This lease has been worked at two points close to the south-west corner, the first being upon a reef which evidently outcropped and was probably the one referred to in Mr. Brown's report as occurring in shafts Nos. 1 and 2.

This reef has been worked to a depth of 107 feet 9 inches by an underlay and vertical shaft; it was not a continuous quartz body, but consisted of broken masses or small lenticular veins. From the bottom level a winze has been sunk 50 feet but no stone was met with. In these workings a faulting cross-course was met with at the bottom of the vertical shaft B, and also in the level at the bottom of the underlay shaft A, its course being a little north of west, with a dip to the northward; it is evidently the same body as is exposed upon the surface to the southward of these workings and between them and the main shaft, having a course nearly east and west. In the other workings, which lie 130 feet to the south-west, a vertical main shaft has been sunk to a depth of 260 feet, a small supply of salt-water being struck at 180 feet. From this shaft a series of small pipe-like lenticular quartz bodies have been worked to a depth of 150 feet, below which no ore has been discovered.

So far as the known ore bodies in this mine are concerned they have no apparent extension downwards below the existing workings, whilst even at the lower levels the veins have either cut out or become exceedingly small and poor; there is, however, a considerable area of untested ground between the existing workings and the Dublin Castle in which other rich veins may exist.

Table showing the Yield of the Lady Sherry Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1897 ...	Menzies Lady Sherry, G.M.L. 3914z	299·00	484·32	1·52			
1898 ...	Do.	449·00	383·20	·85			
1899 ...	Do.	232·00	378·21	1·62			
1900 ...	Do.	131·00	103·36	·78			
1901 ...	Do.	683·00	735·79	1·08			
1902 ...	Do.	414·00	243·08	·58			
1903 ...	Do.	...	13·25	...	2,208·00	2,341·21	1·06
1903 ...	Lady Sherry Leases, G.M.L. 3914z	221·00	286·26	1·29			
1904 ...	Do.	392·25	259·86	·66			
1905 ...	Do.	291·00	198·53	·68	904·25	744·65	·82
	Total	...	...	...	3,112·25	3,085·86	·99

Aspasia and Pandora, G.M.Ls. Nos. 3100z, 3138z.—These leases, which are the property of the Menzies Mining and Exploration Corporation, Ltd., are situated immediately south of the Victory and to the westward of the Lady Sherry, upon them a well-defined reef, which outcrops upon a north-west course with a dip to the south-westward of 53 degrees at the south end and 70 degrees at the north end, has been opened at the surface for a length of 370 feet by a number of underlay shafts. These shafts connect with the No. 1 or 56-feet level, which has been driven for a length of 520 feet, of which 440 feet was in payable stone.

The No. 2, or 117-feet level, has been driven for a distance of 320 feet, the north end to the limit of the pay shoot, whilst the south end was discontinued before that end was reached. The No. 3, or 160-feet level, which is 450 feet in length, has been driven from one end to the other of the ore body, and between it and the surface practically all the ore has been stoped.

A main vertical shaft has been sunk, which has been connected with this level by a crosscut, and also with the No. 4, or 237-feet level, which has been driven for a distance of 300 feet in a well-defined body of stone, that in the south drive, which is 180 feet long, is richer than the northern, but the latter is improving in the face.

From the No. 1 level a crosscut has been driven 100 feet east and 110 feet west, but no other lode of any value was cut.

The outcrop of this lode can be traced throughout the entire length of these two leases, and it is probably the northern extension of one of the reefs worked upon the Aurelia which lies to the southward. The lode is generally rather small in size, varying from 18 inches to 3 feet, but is well defined with a polished and striated footwall, which indicates that it is of the "true or fissure" type, the quartz having been deposited upon the wall of a fault, and in consequence the fissure is probably of considerate extent.

Upon this field veins of this type are not usually so rich as those of the segregation type, but are simpler deposits to handle owing to the fact that, although the quartz may pinch out, the fissure still remains as a guide or leader to further ore bodies. The individual ore chutes are usually of greater length, and so far their limit in depth has not been proved.

Upon this lease a large number of small shafts have been sunk upon small parallel ore bodies, but as yet sufficient work has not been done upon them to determine their character.

In sinking the main shaft, a small supply of salt water was struck at a depth of 144 feet from the surface, but the supply is too small to be of any value.

Since the gold returns from these leases are included in the Company's total, the actual amount yielded has been kindly furnished by the manager.

Total Gold Yield to date.

Ore crushed.	Gold therefrom.	Rate per ton.
tons.	ozs.	ozs.
6,213·00	8,407·00	1·35

The Victory South, G.M.L. 5094z.—This lease is situated immediately to the eastward of the Pandora, and upon it a small shoot of stone has been followed down into the last-mentioned lease.

Table showing the Yield from the Victory South Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1904 ...	Victory South, G.M.L. 5094z	243·00	166·50	·68
1905 ...	Do. „	44·00	145·31	3·30
	Total	**287·00**	**311·81**	**1·08**

The Etrenna and Aurelia, G.M.Ls. 4965z and 4966z.—These leases are a portion of what was originally the Menzies Gold Estates, Ltd., which Company worked them up to the year 1899. In 1900 and 1901 the returns are given under the title of Etrenna and Aurelia leases, after which date they became the property of the Menzies Mining and Exploration Corporation, Ltd., and in consequence the returns have been bulked, but the manager has kindly supplied the figures with regard to the leases.

The Etrenna lease is a portion of what was originally the Crusoe West, G.M.L. 3054z, and upon it a vertical working shaft has been sunk to a depth of 600 feet in extremely hard aphanitic diorite [**6331**], with the object of cutting the dip of the Crusoe reefs at 504 feet and 624 feet. As, however, no lode indications were met with, this work was abandoned (Plate II.). Later developments in the Crusoe prove that the vein did not extend into this lease. Upon the Aurelia, which was formerly called Wilson's, G.M.L. 3046z, three parallel lines of reefs have been worked to a vertical depth of from 80 to 110 feet, below which they decrease both in size and value. The eastern reef has apparently a very long outcrop, and if the working upon the Ishtar, G.M.L. 4976z, which lies to the south, are upon the same line, it gives a total length of 800 feet. The outcrop of this reef has been opened upon on this lease for a length of 450 feet, and driven on at the 63-feet level for a distance of 200 feet, and at the 95-feet level for 90-feet. It is a well-defined reef but of low value, 15dwts. being about the highest, the gold being worth little over £3 10s. per ounce.

The central reef has been driven on at the 56-feet level for a distance of 350 feet, and at the 87-feet level for 30 feet, the ore chute giving out at the bottom.

The western reef has been worked for a length of 350 feet at the 65-feet level and for 160 at the 112-feet level, beneath which the stone was valueless.

These reefs have only been worked in the oxidised zone, but, so far as can be judged, they are of the fissure type. If this should prove to be the case they would be worthy of further development in order to prove whether or not the veins increase in size and value in the solid country, as 110 feet vertical depth is no criterion as to what these lodes may possibly be at a depth.

Table showing the Yield of the Aurelia Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1897 ...	Menzies Gold Estates, Ltd., G.M.Ls. 3012z, 3046z, and 3054z	400·00	131·22	·33			
1898 ...	Do. ...	31·00	18·68	·60	431·00	149·90	·35
1899 ...	Do. ...	...	...	...	...	...	...
1900 ...	Etrenna and Aurelia, G.M.Ls. 4965z and 4966z	123·25	110·07	·89			
1901 ...	Do. ...	101·00	111·17	1·10	224·25	221·24	·98
1902-5	Menzies Mining and Exploration Corporation, G.M.L. 4966z	687·75	618·46				
	Total	...	...	...	1,334·00	989·60	·74

The Ishtar, G.M.L. 4976z, is a portion of what was originally one of the Crusoe block claims, No. 3148z, and if it yielded any gold under former ownership, the record has been bulked and lost. The lease is now the property of the Menzies Mining and Exploration Corporation, Ltd., whose crushing returns are furnished by the manager. Seven shafts have been sunk upon what appears to be the continuation to the southward of the Aurelia reef, but although about 500 feet of driving has been done, no payable lode has been cut.

The Aurelia West, G.M.L. 5011z, is the property of the Menzies Mining and Exploration Corporation, Ltd., and is situated immediately to the westward of the Aurelia.

A shaft has been sunk to a depth of 76 feet, and a crosscut driven 200 feet east and west; in this latter a small vein of stone was cut 30 feet west of the shaft, from which a crushing was taken; at the west end, 90 feet from the shaft, an altered dyke was passed through. Fifty-six tons of stone crushed from this lease yielded 86·95ozs. of fine gold.

The Maori, G.M.L. 5196z., is situated within the township boundaries at the northern side, and covered a portion of the Government Reserve, upon which are the Warden's Court and Police Station.

These leases were originally held by the Maori Gold Mines, Ltd., in 1896 and 1897, which Company had one of the first batteries at work upon the field. All the developments were confined to one lease, No. 3059z, the principal portion of which was re-pegged in 1898 and taken up as the Union Jack, G.M.L. 4889z; in 1901 it changed hands, and became the **Maori**, G.M.L. 4983z; whilst in 1904, with the name retained, it became G.M.L. 5196z.

A considerable amount of work has been done, but the only information obtainable was that a vertical shaft had been sunk to a depth of 280 feet without striking water.

Table showing the Yield of the Maori Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons	ozs.	ozs.	tons	ozs.	ozs.
1896 ...	Maori G M., Ltd , G.M.L. 3059z	496·00	560·50	1·18			
1897 ..	Do. ...	75·00	93·56	1·04	571·00	654·06	1·11
1898	Union Jack, G.M.L. 4889z	80·00	107·07	1·33			
1899 ...	Do. "	281·00	351·24	1·23			
1900	Do. "	232·00	220·79	·95	593·00	679·10	1·16
1901 ..	Maori, G.M.L. 4983z ...	64·00	29·45	·46			
1902 ..	Do " ...	...	51·27	...	64·00	80·72	1·26
1903 .	Do. " ..						
1904	Do. 5196z ...	12·00	2·63	·22	12·00	2·63	·22
	Total	...	...	...	1,240·00	1,416·51	1·14

The **Freeman**, G.M.L. 5039z, is a portion of the original Maori, and lies immediately south of the main workings upon what is now the Railway Reserve, therefore all the old shafts have been filled in. From this lease 3,000 tons of stone were crushed which yielded 20·75ozs. of fine gold.

The **Menzies United** was the name by which G.M.L. 3345z situated within and upon the south side of the town, was known. In 1902 it was taken up as the **Horseshoe**, G.M.L. 5045z, and in 1904 as the **Menzies Horseshoe**, G.M.L. 5145z; it is now abandoned.

Table showing the Yield of the Horseshoe Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1898	Menzies United, G.M.L. 3345z	12·00	3·21	·26	...	...	...
1899	Do. ..	127·00	92·88	·73	139·00	96·09	·69
1902 ..	Horseshoe, G.M.L. 5045z	43·00	13·74	·31	43·00	13·74	·31
1904 .	Menzies Horseshoe, G.M.L. 5145z	62·50	19·02	·30	62·00	19·02	·30
	Total	...	...	...	244·00	128·85	·52

The Crusoe Gold Claims, Ltd., own four leases, viz., Robinson Crusoe, G.M.L. 2823z; Robinson Crusoe East, G.M.L. 3009z; Naida, G.M.L. 5017z; and Friday, G.M.L. 5018z. As now constituted, it is an amalgamation of the Menzies Crusoe Gold Claims, Ltd., and the Menzies Gold Reefs Proprietary, Ltd.

The Crusoe mine is situated upon lease 2,623z., and consists, roughly, of three groups of workings, besides a large quarry from which a considerable quantity of auriferous gravel was raised, in the laterite capped hill upon which the battery stands. The three groups of workings may be classed as follows:—First, the extension and dislocated extension of the Queensland Menzies lode, which outcrops at the south-west corner of lease 3009z, and underlays into the south-east corner of 2823z and the Queensland Menzies; second, the central group which is situated about midway between the other two groups at the centre of the southern portion of lease 2823z; third, the main group lies in the centre and extends towards the north-east corner of the same lease.

In 1895, Mr. H. Y. L. Brown says: "The lode formation in this mine is a quartz reef associated with quartz and ironstone veins in a white kaolin rock apparently a decomposed felsite. This is of considerable width in places, but irregularly defined. Rich specimens of gold are found in the formation generally." *

First. A considerable amount of work has been done upon the outcrop of the Queensland Menzies shoot, but the line of reef has apparently been dislocated by cross courses. A deep shaft was sunk and a considerable amont of crosscutting done to the northward of this break, but no indications of the continuation of the reef could be obtained. No. 3 shaft is an underlay in the corner of lease 3009z, and appears to have been sunk on a portion of the Queensland Menzies outcrop, which was worked to a depth of 72 feet; all the other workings in this locality are inaccessible and there are apparently no plans other than of No. 3 shaft.

Second. Here three shafts have been sunk upon a reef which runs in a north-westerly direction, and dip to the south-west. From the northern shaft B, a winze has been carried down 155 feet upon a pipe of ore which dips south. A cross vein which strikes east and west and underlays north passes through these workings, which are not now accessible.

The main workings (Plate II.) lie about 270 feet to the northwest of the last; the reef, which has a course of from north to a little east of north, has been worked by a main vertical shaft 340 feet in depth and a series of underlay shafts and winzes.

There were three shoots of ore in this mine; the first or northern shoot was small and only about 40 feet in width, cutting out at the 60 feet level. The second and third shoots were worked as one continuous ore body of 280 feet in length from the surface down to the 60 feet level, below which, however, the northern portion pipes off decreasing in size to 80 feet at the 156 feet level, and dying out about half-way between this level and the 235 feet level. The southern shoot which was the largest and longest in the mine was 170 feet wide at the 80 feet level, 130 feet at the 235 feet level, but below this it suddenly closed in to 50 feet in width, which gradually diminished until it died out altogether, a little below the 333 feet level. The sudden decrease in size is apparently due to the fact that a thrust plane makes its appearance coming in diagonally from the footwall, this may, if the dislocation took place after the formation of the reef, have severed a portion of the shoot below the 235 feet level. Indications rather point, however, to the prior existence of this thrust plane, in which case the reef fissure will be found to terminate upon it; this question could have readily been determined by an examination of the quartz at its contact with the fault at the time the stone was being worked.

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* *Loc. cit.*, p. 4.

The quartz veins in this mine have no polished walls or casing, the stone adhering firmly to the rock in the hard ground, whilst no line of fissure is met with after the stone has ceased to exist, therefore clearly pointing to their origin by segregation, and not by the upflow of magmatic solutions. That no continuation of the ore channel exists in depth has been clearly proved in the adjoining property, where the Menzies Gold Estates, Ltd., sunk a deep shaft with the object of cutting this lode. Nothing, however, but very solid rock was met with. There is no water in these workings, whilst the country is fairly soft to the 235 feet level [**6322**, **6323**, **6325**, and **6326**].

To the northward of these workings a small quartz body, with a north-easterly course, has been worked to a depth of 144 feet, but it has apparently no continuity.

Whilst doing some work in connection with the battery, which is situated upon a low ironstone hill at the south-east corner of the lease, a deposit of auriferous gravel was met with, the gold in which was of a much higher value than that obtained from the reefs. A number of small shafts were sunk, and a considerable amount of crosscutting and trenching done with the object of locating the source from which this gold was derived. Since, however, no reef or leader was met with it is evident that this deposit is merely a surface accumulation resulting directly from the weathering of the rocks themselves, which often carry gold in small quantities along this belt.

All the known ore-shoots upon this mine are practically worked out, but as there is a considerable area of ground still unprospected other veins may yet be discovered upon the property, whilst crosscutting below the 235 level may possibly reveal a dislocation of a portion of the main ore-shoot.

Table showing the Yield of the Crusoe Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total. Ore crushed.	Total. Gold therefrom.	Average rate per ton.
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1896 ...	Menzies Crusoe Gold Claims. Ltd., G.M.L. 2823z	3,244·00	6,226·42	1·91			
1897 ...	Do.	4,199·00	5,631·23	1·34			
1898 ...	Do.	2,287·00	3,744·09	1·64			
1899 ...	Do.	6,077·00	6,399·21	1·05			
1900 ...	Do.	946·00	611·72	0·64			
1901 ...	Do.	1,726·00	1,319·58	0·65	18,479·00	23,932·25	1·24
1902 ...	Crusoe Gold Claims, Ltd., G.M.L. 2823z	675·00	720·30	1·07			
1903 ...	Do.	1,562·00	1,005·79	0·64			
1904 ...	Do.	6,005·00	2,818·84	0·47			
1905 ...	Do.	3,533·00	1,417·93	0·40	11,775·00	5,962·86	0·50
	Total	...	...	...	30,254·00	29,895·11	0·99

Queensland Menzies Gold Mining Co., N.L.—This Company's property consisting of two leases, the Wedderburn, G.M.L. 2836z, and the Oceanic, G.M.L. 4969z, is situated upon the main auriferous belt, the Oceanic being within the town of Menzies, and the Wedderburn immediately west of it and south of the Crusoe.

The Queensland Menzies mine is upon the Wedderburn lease, whilst the Oceanic, from which a small amount of gold was previously obtained, was taken up as a block claim in 1891, since which time very little work was done until recently, when a long crosscut was started with the object of testing the lease for lodes.

The Wedderburn was taken up in 1895, in which year Mr. H. Y. L. Brown says of it in his report:—"This is a quartz reef in which coarse gold is visible, striking N.N.W." * It has been continuously worked ever since, and has been one of the most profitable mines in the Menzies district.

The outcrop of the reef was discovered at the north-east corner of the lease, and was traced in the south-west corner of the Crusoe, G.M.L. 3009z, the entire length being something like 500 feet.

The developments upon this mine, until quite recently, consisted entirely of working shafts, levels, and winzes in the ore body, and crosscuts from the shafts to the levels; when, however, the vein gave signs of pinching out, at the instance of Dr. Jack, who was called in to advise the owners, a certain amount of prospective driving and crosscutting was undertaken.

A main vertical working shaft has been sunk to a depth of 540 feet, and an old main shaft 240 feet, an old water shaft 175 feet, and an underlay shaft 80 feet (Plate III.). Eight levels have been driven at 60 feet, 90 feet, 183 feet, 230 feet, 300 feet, 366 feet, 446 feet, and 534 feet respectively, vertical depth from the surface,

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* *Loc. cit.*, p. 4.

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he Hon. H Gregory. M.L.A
Minister for Mines

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the total length of which, inclusive of crosscuts, is about 3,000 feet. From a crosscut at the No. 8 level the lode has been followed down for a further distance of 210 feet on the dip to near the boundary of the adjoining property, the bottom of which is 617 feet vertical depth below the surface.

A small supply of salt water averaging about 100 gallons a day was cut at 150 feet below the surface beneath which a zone of about 50 feet of saturation was passed through, then hard impervious rocks were encountered.

The rocks which enclose the ore bodies may be divided into three zones, first, from the surface downwards about 100 feet may be called the oxidised zone in which the rocks gradually pass from yellow greasy clays into weathered schists of an argillaceous and chloritic nature; in the second, which may be called the zone of hydration, rocks of a more compact nature are met with, such as serpentine and hornblende schists; whilst in the third, or sulphide zone, which starts below the water-charged rocks an extremely hard aphanitic diorite is encountered, this rock, although presenting no foliation, has a distinct cleavage which is identical with the foliation of the schists; this although not always apparent very quickly develops upon exposure to the atmosphere, whilst the dormant and accompanying cross heads are taken advantage of in breaking ground [**6311, 6312**, and **6324**].

The schists have a defined and very uniform foliation, the planes striking 20 degrees west of north and underlaying at an angle of about 45 degrees to the south-westward, whilst the ore chutes lie upon and cross these planes diagonally dipping at an angle of 35 degrees on a course of 15 degrees west of south.

The ore body in this mine although presenting the appearance of one continuous lode in the oxidised zone composed of quartz and formation on approaching the more solid country rapidly formed into a number of pipe like veins, the largest of which received distinctive names such as the western, eastern and hanging wall veins. The breadth of these combined ore bodies decreases rapidly with depth, starting with 500 feet (inclusive of the Crusoe) near the surface they become reduced to 150 feet at the 446 feet level, whilst the total width at the bottom of the winze, the lowest portion of the mine, does not exceed 20 feet. This is not only due to the diminution in size of the individual veins, but more particularly to the fact that they gradually die out one after the other until at the bottom only one remains and that very emaciated.

The ore-shoot in this mine has an exceptional length for a vein of this character in this district, it being 1,125 feet on the dip from the surface to the present bottom.

The individual quartz bodies vary very greatly in size, being of a lenticular pipe-like form; they start from nothing, gradually expanding until their maximum thickness, which may be many feet, is attained, then gradually diminish again. In consequence, it is impossible to state what is the average size of the stone, but if the area of the stoped ground is taken, and the stone crushed cubed back into the solid, it gives an average of something like two feet of stone, which has averaged over 1½ozs. of fine gold per ton.

These veins have no walls, in the accepted mining sense, the quartz being attached to the enclosing rock, whilst small strings of quartz often penetrate it for a considerable distance. The solid diorite rock in the immediate vicinity of the veins often carries gold in appreciable quantities, specimens having occasionally been met with in which coarse particles of gold were visible without the aid of a glass.

The enclosing fissures present all the appearance of shrinkage contortion cracks, having no continuity in depth nor length, and, although a number of them may occur in a group, or even upon the same planes of foliation, no connection whatever exists between them; they are therefore clearly segregation veins, the mineral matter, including the gold, having been infilled by percolation, either vertical, lateral, or both.

The group of veins worked in this mine lie at a point where a slight change in the course of the foliation has taken place; therefore the formation of the fissures may be due to the crumpling or buckling of the rocks after the release by thrusts of the lateral pressure, which caused their elongation or stretching. The quartz in the sulphide zone is often heavily charged with galena and iron pyrites, the former being a sure indication of the presence of gold. To the eastward or upon the footwall side of the ore body, a belt of indurated and highly fissile schist is encountered at several points in this mine, where cross-cutting has been done in that direction; this is clearly a thrust plane and is said to cause a fall in the ore values when it approaches the lode.

Upon the western side or hanging wall, a large well-defined quartz body, very heavily charged with pyrites, called the mineral lode, has been cut at several points, but this body carries very little gold.

Driving in this mine along the course of the lode has failed so far to disclose any other ore bodies, but in order to make this prospecting thorough, the country should be cross-cut, at intervals of at least every 50 feet to the schist on the one side and the mineral lode on the other; should this fail to disclose the presence of other chutes, it may be assumed that the veins in this mine do not extend north and south beyond the buckled area referred to above, in which, however, there is still the chance of other veins being picked up, and this point should be determined before any further exploration is undertaken.

Since these veins are apparently filled by percolation and have proved to be more numerous, of greater size and richness in the upper levels, prospecting in that portion of the mine would offer greater possibilities than the lower levels, but at the same time veins cut in the latter are almost certain to extend into the former, but on the other hand those met with in the former may or may not extend into the latter. This lode on the whole has been free from trouble, the first fault being met with near the bottom of the mine; this threw the reef several feet to the eastward, but upon a second fault being encountered further work was abandoned since the stone was not only small and of little value but there was no great distance to drive to the boundary of this property.

Table showing the Yield of the Queensland Menzies Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896 ...	Wedderburn, G.M.L. 2836z	41·00	251·78	6·14
1897 ...	Do. „	4,031·00	12,856·03	3·19
1898 ...	Do. „	2,429·00	6,894·27	2·83
1899 ...	Do. „	3,500·00	7,801·38	2·25
1900 ...	Do. „	3,143·00	6,113·98	1·94
1901 ...	Do. „	2,962·00	6,621·63	2·57
1902 ...	Do. „	5,155·00	8,124·33	1·57
1903 ...	Do. „	7,249·00	10,029·75	1·38
1904 ...	Do. „	9,973·00	6,874·46	·69
1905 ...	Do. „	6,368·00	8,241·21	1·29
	Total	**44,851·00**	**73,808·82**	**1·64**

The Oceanic, G.M.L. 4969z, adjoins the Wedderburn upon the east, and covers a portion of the township. It is now the property of the Queensland Menzies Co., but was worked as G.M.L. 4920z in 1899, when 101·00 tons of stone were crushed, yielding 62·13 ozs. of gold. Since then the Company has crushed 50·00 tons, which yielded 26·52 ozs. of gold.

The Menzies Gold Reefs Proprietary, Ltd., which has now amalgamated with the Menzies Crusoe Gold Claims, Ltd., under the title of the Crusoe Gold Claims, Ltd., originally owned a large number of leases, situated at different parts of this district, but finally abandoned all with the exception of the Friday G.M.L. 2825z and Naida G.M.L. 3016z, and it was upon the former of these that all the work was concentrated in what was known as the Friday mine.

This mine is situated to the southward of the Queensland Menzies, and to the westward of the town, at about the centre of the main auriferous belt. It was taken up in the year 1895, and was shortly after inspected by Mr. H. Y. L. Brown, who says:—"This possesses a well-defined quartz reef, having a strike north-west and northerly, and dipping south-west at an angle of about 40 degrees. The veinstone consists of bluish, laminated, and veined quartz, containing galena, pyrites, and coarse gold." *

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* *Loc. cit.*, p. 4.

This mine has now been completely closed down for some years; the following information is, therefore, taken entirely from the working plans, records, and information obtained from reliable sources (Plate IV.).

There are three main levels in this mine: No. 1, or 80-feet, is 350 feet long; No. 2, or 150-feet level, is 450 feet long; No. 3, or 200-feet level, is 500 feet long; whilst from the No. 3 level a winze has been sunk to a depth of 100 feet upon the underlay of the lode, and from it a level has been driven for a distance of 70 feet at a vertical depth of 240 feet, or 30 feet from the bottom of the winze. In the Menzies United, Ltd., property, which adjoins this lease to the south, the continuation of this lode was cut, and proved to be of no value, and died out at the 388-feet level.

Two underlay shafts connect the No. 1 level with the surface, whilst a main vertical shaft has been sunk to the 200-feet level. A crosscut has been driven from the 150-feet level 180 feet east, where a mineral lode was cut, which is evidently the same reef as outcrops at the surface, near the eastern boundary.

Judging from the plan a defined ore-shoot with a southerly dip was worked down to the 200-feet level beneath which it tapered off into a pipe, becoming small and low in value, until work was abandoned before the boundary was reached. This ore body dipped at an angle of 53 degrees at the north end but flattened to 40 degrees towards the south; the thickness of the stone is said to have ranged from three tó 18 inches.

Good stock water was struck at a depth of 129 feet, the daily yield being estimated at 500 gallons.

This reef was evidently of the lenticular fissure type, and probably consisted of a series of pipes, which become more or less united in the upper levels; the southernmost one, as is generally the case, extended to a greater depth than the others. The continuation of this shoot was cut in the Menzies United, Ltd., lease Balkis, which adjoins and will be mentioned later.

With the exception of the crosscut east to the mineral lode mentioned above, little prospecting has been done to prove to prove the existence of other lodes, whilst upon the Naida, which adjoins to the north, and upon which the battery is located, absolutely no work has been done.

Since these leases (the Friday and Naida, which are now held) are situated in the very heart of the auriferous belt, it is very probable that other reefs may exist beneath the alluvial covering; this could be determined by trenching and crosscutting for a fairly moderate cost.

It was mentioned previously that the Queensland Menzies shoot was lost on a fault near its boundary; had this continued it would have extended into the Naida, which adjoins it to the westward. Judging, however, from the character of the vein at the bottom of [illegible] without result.

the mine, there is little prospect of stone of any value continuing, although a small pipe of quartz may do so.

Table showing the Yield of the Friday Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1896 ..	Friday G.M.L. 2825z ...	2,272·00	2,986·47	1·25			
1897 ..	Do. ,, ...	2,531·00	2,640·21	1·04			
1898 ..	Do. ,, ...	501·00	3,234·25	6·45			
1899 ..	Do. ,, ...	667·00	991·18	1·48	5,971 00	9,802·09	1·64
1900 ..	Do. 4939z ...	37·00	877·86	23·72			
1901 ..	Do. ,, ...	16·00	36·16	2·26			
1902 ..	Do. ,, ...	...	465·26	...	53·00	1,379·23	26·02
1902 ..	Do. 5018z ...		94·51				
1903 ..	Do. ,, ...	39·00	17·71	·45	39·00	112·22	2·87
1904 ..	Do. ,, ...						
1905 ..	Do. ,, ...						
	Total	...	...	...	6,063·00	11,293·59	1·86

The Menzies United Mines, Ltd.—This Company owned a group of leases to the westward of the Friday, upon one of which, called Balkis, G.M.L. 3151z, a deep shaft was sunk with the object of cutting the underlay of the Friday load. The position chosen for this shaft was unfortunate, owing to the fact that no allowance was made for the southerly pitch of the ore-shoot (which at the time was probably not demonstrated); this necessitated extension driving through barren ground in a southerly direction in order to pick it up, this work being of absolutely no value from an exploratory point of view.

At a vertical depth of 388 feet, a level was driven south from the main shaft for a distance of 330 feet, when it encountered a small vein which split into two to the southward. (Plate IV.)

At the junction of the two veins a rise was carried up on this small ore body towards the Friday boundary, and a small intermediate level driven south 65 feet. A small parcel of stone was crushed from this rise and level but the vein was too small to be remunerative. Two crosscuts were driven, one east and one west, from the 388-feet level to the northward of the ore-shoot in which nothing was cut resembling a formation.

At a depth of 150 feet stock water was cut, which yielded a supply of about 400 gallons per diem.

Upon the leases owned by this Company a total of about 2,000 feet of sinking and 2,500 feet of driving has been done without result.

The Balkis is at present held by the Menzies Mining and Exploration Corporation, Ltd., which Company has failed to prove the lease of any value, whilst the others have been pretty well prospected since their abandonment without result.

From this lease 132 tons of stone have been crushed, which yielded 138ozs. of fine gold.

The Central Menzies Gold Mines, Ltd.—This Company also owned a lease called the Emulator, G.M.L. 2834z, which lies to the north of the Friday, upon which 484 feet of sinking and 790 feet of crosscutting was done with the object of cutting the northern extension of that reef. All this work, however, proved to be valueless.

The only crushing from this lease was in 1900, when 19·00 tons were treated, and yielded 18·15ozs. of gold.

The Menzies, Ltd.—This was another of the old Exploration Company's, that held a number of leases, consisting of the Lady Shenton North, G.M.L. 2826z, Florence North, G.M.L. 2828z, Pericles, G.M.L. 2829z, Shirkin, G.M.L. 3050z., Fennine, G.M.L. 3051z, Bantry, G.M.L. 3055z, and Stuart, G.M.L. 3056z. Upon these leases, with the exception of the Shirkin, of which lease no plans exist, 700 feet of sinking and 1,360 feet of driving was done, the only reproductive work being upon the Shenton North, where the outcrop of a lode was worked which dips into the Leonidas.

This Company appears to have abandoned these leases in 1901, when they were retaken by the various Companies and parties of working miners.

Flying Fish Leases.—These leases are situated upon a portion of what was originally the Shirkin, which lies upon the south-west side of the town, and to the north-east of the Friday. They have been worked continuously since 1901 upon some small but rich quartz veins of the usual segregation type in the oxidised zone.

Table showing the Yield of the Flying Fish Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons	ozs.	ozs.	tons	ozs.	ozs.
1901 ..	Flying Fish G.M.Ls. 4982z, 4991z	56·00	98·19	1·21			
1902 ...	Do. ...	107·70	472·78	4·39			
1903 ...	Do. ...	46·30	159·69	3·47	209·50	730·66	3·48
1903 ...	Flying Fish G.M.L. 5089z	180·00	548·16	3·04			
1904 ...	Do. „	215·00	447·58	2·08			
1905 ...	Do. „	304·00	265·58	·87	699·00	1,261·32	1·80
	Total	...	...	...	908·50	1,991·98	2·19

The Lady Shenton North.—This lease, as stated above, was worked by the Menzies, Ltd., from 1898 to 1900, after which it was abandoned, since which it has been taken many times in varying forms by working miners, who have pretty well riddled the ground from the old workings to the surfaces of a lode which outcrops upon it, but underlies into, and has been worked upon, the Leonidas, the adjoining lease to the westward [756.]

Table showing the Yield of the Lion Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1898	Lady Shenton North G.M.L. 2826z	69·00	194·28	2·81			
1899	Do.	116·00	220·85	1·19			
1900	Do.	53·00	42·15	0·79	303·00	457·23	1·49
1901	Success G.M.L. 4987z	110·00	78·77	0·71			
1902	Do.	10·00	35·32	3·53	120·00	114·09	0·95
1902	Rescue G.M.L. 5065z	15·00	22·38	1·88			
1903	Do.	33·00	56·68	1·71	48·00	79·06	1·64
1903	Lion G.M.L. 5069z	48·00	115·91	2·41			
1904	Do	8·00	7·21	0·90	56·00	123·12	2·19
1904	Sentinel G.M.L. 5204z	50·00	31·86	0·63			
1905	Do.	5·00	3·72	0·74	55·00	35·58	0·64
1905	Lion G.M.L. 5244z	43·00	56·70	1·32	43·00	56·70	1·32
	Total	...	...	..	630·00	865·78	1·37

The Leonidas, G.M.L. 2382z.—This lease, which is the property of the Menzies Mining and Exploration Corporation, Ltd., runs in a more easterly direction than is usual; it was taken up on the dip or western side of a line of lode which outcropped in the Shenton North and Pericles.

There are three groups of workings which may be upon dislocated portions of the same vein, the outcrops of which were worked in the Shenton North to a depth of 100 feet below which it passed into this lease.

At the end of this lease a vertical shaft has been sunk to a depth of 130 feet, from which a level has been driven 70 feet north and 110 feet south, a winze was also sunk upon the lode; and another level driven at 172 feet, north 90 feet and south 110 feet, the reef averaging here a little over 12 inches in thickness, worth 13dwts.

The water-level in these workings was 152 feet, the yield being 150 gallons of salt water per diem.

A little south another vein which outcrops in the Shenton North has been worked by two vertical shafts to the 77-feet level, which is 150 feet long, from which the lode was winzed down on to the 122-feet level, and from this depth the lode was driven on for a length of 300 feet; from the other shaft, a winze was sunk to the 170-feet level which was carried on for a distance of 70 feet.

Farther south but still upon the north-eastern boundary, another small quartz vein has been worked by a vertical shaft to a depth of 143 feet, and a level driven 220 feet, the reef at this level averaging about 12 inches, worth about 10dwts. The returns furnished by the manager are as follow:—3,457 tons of stone have been crushed, which yielded 2,948·71ozs. of fine gold.

The Florence Gold Mines, Ltd.—This property, which consists of the Florence G.M.L. 2821z, Pericles G.M.L. 2829z, Florenc Extended G.M.L., 5203z, and Bantry G.M.L. 3055z, is situated upon the main auriferous belt north and adjoining the Lady Shenton and south of the Friday.

The whole of the work done by this Company may be said t be confined to the Florence lease, the first start being made by sinking a main shaft to a depth of 210 feet near the centre of th property with the object of cutting the Lady Shenton lode. Fro this shaft cross-cuts were driven in a north-easterly direction at th 60-feet level for a distance of 435 feet, at 110 feet for a distance o 173 feet, and at 160 feet for a distance of 142 feet. In the 60-fee cross-cut a small body of stone was cut dipping south at a distanc of 285 feet from the shaft, which was driven on 27 feet west an 135 feet east; this level is connected with the surface where this ree outcrops by an underlay shaft.

This vein was also cut in the two lower cross-cuts, being drive on for a distance of 30 feet east at the 110-feet level and 75 fee west and 90 feet east at the 160-feet level. At the end of thi eastern drive, a cross-course dipping to the northward was cut an followed east for 16 feet. This cross-course is evidently the sam as outcrops at the surface to the southward of the main shaft. A 200 feet from the surface a small drive east and west was drive from the shaft.

In 1898, the Shenton Company having traced one of these ric shoots up to the south boundary of the Florence, work was starte in that locality and what is called the New Main Shaft sunk to depth of 300 feet and the reef worked by means of three level This reef proved to be the top of the Shenton northern shoo which was found to be considerably broken in the lower levels b cross-courses in both properties and to die out before reaching th 300-feet level, whilst to the northward the top of the shoot whic dips south ended abruptly upon coming in contact with an east an west cross-course dipping north. This cross-course which terminate the lode has been met with at a distance of 40 feet north of th boundary in the 60-feet level, 100 feet in the 150-feet level, whils in the 200-feet level it was cut at a distance of 135 feet but th level was not continued because the ore-shoot stops on anothe cross-course met with in this level at a distance of 80 feet from th boundary which governs its northern extent down to the 260-fee intermediate level below which there is no stone. (Plate V.)

A winze was sunk on the formation from the bottom of th main shaft for a depth of 213 feet, but in it no stone was cut. A 150 feet from the surface the level was continued beyond the cross-course for a distance of 135 feet, from which point cross-cuts were driven 100 feet both east and west without result and thus proving that the Shenton reef did not continue north.

length of over 100 feet by rich specimens scattered upon
surface.

Shenton reef did not continue north.

One of the porphyritic dykes crosses this lease between the two main shafts striking west-north-west and follows the outcrop of the Leonidas lodes, whilst another branch from it was cut in the old main shaft, from which point it appears to run north-west, being cut in the Pericles [**6343**] and the cross-cut in the Shenton North. These dykes in no case where observed appear to have caused any disturbance so far as the lodes are concerned, since these latter often cross or follow them [**6342**].

A number of other small segregation veins which cross this property upon the normal north-westerly course have been opened up and are still being worked in the oxidised zone; it is from this source that the entire production of the mine has been derived for the last year or two.

At the north-east corner of the lease is a water-shaft called the donkey shaft, in which the water-level is 200 feet, the yield being estimated at 6,000 gallons per diem, and is stated to be suitable for stock. There is also a water-shaft on the Florence Extended, G.M.L. 5203, which was originally the Fenine, G.M.L. 3051, being 213 feet in vertical depth with a cross-cut west 241 feet and east 120 feet at the 157-feet level and 40 feet east at the 213-feet level. In the Pericles, a shaft has been sunk to a depth of 100 feet and a cross-cut driven 231 feet in a north-east direction in which only small veins of stone were cut.

Table showing the Yield of the Florence Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom	Rate per ton.
		tons.	ozs.	ozs.
1896 ...	Florence, G.M.L. 2821z	300 00	465·29	1·55
1897 ...	Do. „	...	129·82	...
1898 ...	Do. „	185 00	439·20	2·37
1899 ...	Do. „	1,205·00	842·05	·70
1900 ...	Do. „	1,735 00	1,430·50	·82
1901 ...	Do. „	1,252·00	1,082·86	·86
1902 ...	Do. „	415·00	400·81	·96
1903 ...	Do. „	365·00	352·56	·97
1904 ...	Do. „	591·00	547·78	·91
1905 ...	Do. „	616·00	664·01	1·08
	Total	**6,664·00**	**8.354·86**	**·95**

The Lady Shenton Gold Mine, Ltd.—This mine, which is situated to the southward of the town, upon G.M.Ls. (1380), 2820z, and 3006z, was not only the first discovery made in this district but it also proved to be by far the richest.

It was discovered in September, 1894, by Messrs. Menzies and McDonald, who were able to trace the outcrop of the lode for a length of over 100 feet by rich specimens scattered upon the surface.

In 1895, Mr. H. Y. L. Brown writes:—"This is on two quartz reefs, one of which strikes north 20 degrees west, and the other east and west. The angle of the underlie averages 45 degrees, but in some places it is less. The gold occurs in quartz, and is often associated with galena and zinc blende. The rocks consist of argillaceous talcose schist above the water-level, with hornblendic slate below. In connection with the quartz-reefs, there is a soft soapy clay which is apparently a decomposed felspathic rock; other shafts near are sunk in green chloritic talcose and argillaceous schists and brown decomposed igneous rocks." * **[1036-1044.]**

This mine is now full of water to a little above the No. 6 level, whilst above the No. 5 level, which is the lowest that is accessible, practically all the ore has been stoped and most of the stopes filled in. Lately this mine has been in the hands of tributers who have not improved matters from an inspection point of view, since in working portions of the reef which were much disturbed or considered too small by the Company a considerable quantity of rock had to be broken which was not worth raising and was therefore packed below, thus blocking up places that were accessible before.

Both in the stopes and levels very large excavations have been taken out in places; these however do not, it is stated, represent the size of the quartz-vein, but either the enriched rock zone adjoining or a series of veins with interbedded rock.

The mine was first opened by underlay shafts from the surface by means of which some very rich stone and enriched decomposed rock (formation) was worked, but later on a vertical shaft was sunk to a depth of 200 feet where it cut the lode in the hard sulphide zone, and from the bottom of this shaft the No. 4 level was driven. Above this level the country softens rapidly, passing from schistose rock into a yellow and brown argillaceous formation. The Nos. 5 and 6 levels were worked by a winze sunk close to the shaft bottom, whilst another main winze was sunk further north from the No. 5 to the No. 8 level. (Plate V.)

In the west lease a main shaft was sunk in very hard country to the dip called Ray's shaft to a depth of 620 feet; this shaft is now connected with the Nos. 8 and 9 levels by cross-cuts. **[6341.]**

Although no water was encountered in the original workings it was cut in this shaft at a depth of 100 feet, below which a water-bearing zone of 200 feet was passed through, the yield varying from 1,000 to 6,000 gallons per diem.

All the stopes are situated above the No. 6 level, for below this, in spite of the fact that a strong reef was followed down upon which a considerable quantity of work has been done, no ore of a payable character was met with.

The ore-body in this mine was of a composite character, *i.e.* it consisted of a number of more or less lens-shaped quartz veins or pipes (elongated lenses) which follow the foliation planes of the rock in a south-westerly direction, the dip of the planes varying here from 53 degrees at the north end of the mine to 45 degrees at the south.

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* *Loc. cit.*, p. 4.

The auriferous veins lie upon these planes, dipping diagonally across them at an angle of 34 degrees to the southward, thus the northern shoot that was worked in the Florence dips into the Shenton whilst the main shoot in this mine dips into the Alpha.

In the oxidised zone the character of these shoots was not well defined owing to the presence of a large number of minor veins and the enrichment of the adjoining decomposed rock due to concentration; as a consequence the true character of this ore body was not understood until the more solid country was reached where the veins began to contract into pipes. The impression gathered with regard to this lode some years ago was that a large rich formation enclosing a more or less broken quartz reef extended from one end of the upper levels to the other; whilst in the sulphide zone the quartz-reef had formed into a definite solid body of variable size enclosed in a formation the walls of which had not been cut.

Near the surface the whole of the stone and formation was worked for a length of something over 600 feet, whilst below this the breadth of the ore body steadily increased until at the No. 4 level (200 feet) it extended for a length along the levels inclusive of the Florence of over 1,000 feet. Directly this level was passed and the sulphide zone entered the lode split up into three definite shoots with blank ground between them, whilst below the three shoots gradually contracted until at a vertical depth of about 300 feet they died out altogether.

The quartz in this mine has no defined walls or casing, and where a semblance of a wall is met with it is found upon careful examination to be only one of the cleavage planes of the rock upon which the vein has been formed. Individual quartz-veins, as far as can be judged from the small veins now being worked, have no connection with each other but lie upon parallel planes of cleavage often overlapping each other, or in the case of three may lie in a splice-like manner. No signs of fissure plane can be observed although often in driving small threads of quartz have been followed for a considerable distance, which gave the impression that such a plane was being followed. These veins were often most misleading, since upon several occasions in this mine these were followed until they died out, whilst other ore-bodies existing upon parallel planes were missed and not discovered until later by cross-cutting. The ore-body in this mine is considerably disturbed by a series of cross-courses, some of which are represented by solid barren quartz-veins. These cross-fissures, which mostly run in a more or less east and west direction and dip to north, generally follow the cross joints of the rock and have in cases displaced the ore body, the throw being either east or west according to whether they are normal or reversed faults. They are in all probability inclined V faults, the southernmost of the pair being more oblique than the northern.

In places in this mine two or more minor faults have apparently intersected the lode in close proximity, causing such considerable disruption that even driving the levels through them was attended with considerable danger and difficulty, whilst certain portions of the ore-body could not be worked. This ore in many places has now been taken out by the tributers but it shows in the accompanying plan of the stopes as solid ground. (Plate No. V.)

Although these faults have undoubtedly caused considerable trouble in places it is quite apparent that many of the so-called displacements are nothing of the kind but simply represent the southern termination of one vein, whilst another has been met with upon parallel planes either east or west.

At the present time about the only point in the mine where the true pitch of the ore-pipes can be observed is in what is called the P. Grade, which is situated near the north-east corner of the Alpha between Nos. 4 and 5 levels. The shoot here has a well-marked pitch of about 34 degrees south, but comes to a sudden stop upon the cross-course which has at this point dislocated the lode. If the grade of this shoot is followed upwards to the surface through the oxidised zone it will be found to cross the No. 2 level to the eastward of the main shaft and to come out upon the surface at the point where the original rich outcrop was discovered, whilst if followed downwards after allowing for the throw it will be found to continue to the bottom level of the Alpha. If this is taken as the true dip of the ore-shoots in this mine (which is supported by the fact that the grade is identical with the ore-shoots in the other mines) it becomes apparent at once that there are three main shoots all of which terminate at the No. 6 level, whilst at the south end there is either another short one or, which is more probable, it represents the splaying out of this shoot similar to the Queensland Menzies. This is not at all an uncommon characteristic of this class of lode, the ore-body presenting the appearance of a series of inclined V's, the apex of which points south, the lower side dipping at an angle of about 35 degrees, whilst the upper, which is much more acute, is bounded by a line which dips at an angle of from 70 to 75 degrees; this is on the inclined plane, not as appears in the foreshortened vertical section of the ore-shoots, Plate V.

This splaying out of the ore-shoot towards the surface in a more or less vertical manner causes the various distinct chutes met with below to unite in the upper levels and in consequence to appear like one continuous ore-body.

It is not at all clear that the strong reef which is reported to have been cut in the workings below the No. 6 level is the continuation of the rich ore body worked above, but this point could not be investigated on account of the water. It would be quite exceptional to find a vein of this class continuing strongly in depth without gold values, the usual character being for a rich vein to gradually decrease in size and to finally die out, and this is said to have been the case at the terminations of the ore-shoots at the No. 6 level. It is quite possible that a barren lenticular body has formed at most generally parallel to these termini, but it is much more probable in this case that the barren footwall reef has been cut and followed down since this has the appearance of being a much more permanent body.

In any case the deeper workings are so situated as to have little prospect of cutting the ore-shoots if they continued, and as will be seen by reference to Plate No. V. that the No. 7 level and the extension south end of No. 8 could only possibly have cut the Florence shoot, which being the northern chute, if this ore-body follows the general character, would be the least likely to continue.

The other ore-shoots lie well to the southward of these workings and would rapidly cross the boundary into the Alpha, this however is apparently not the case as is demonstrated by the extensive works carried out upon the last-mentioned property, a description of which will be given next.

The cross-section of the mine reproduced was prepared by Mr. Robert Falconer, the manager, and shows the relation of the Shenton lode to a granite dyke which lies to the eastward. (Plate V.)

This dyke can be traced at points upon the surface and by the dumps along its course for a considerable distance, and is the same which crosses the Florence Mine after splitting into two branches. Although a solid porphyritic granite was cut in the bore at the bottom of the main shaft and also in the extension east of the No. 8 cross-cut, this dyke has been subjected to the same conditions such as hydration with attendant crushing that have changed the diorite into schists, the alteration in this case being from granite to gneiss, gneiss to mica and sericite schist, the foliation of which is identical with that of the surrounding rocks. [**6336.**]

This added to the fact that in no instance has a dyke been known to dislocate a lode whilst the quartz-bodies are found in and crossing them proves their prior existence to the lodes, which latter were apparently not formed until after hydration had taken place.

This Company has employed every practicable means at its disposal in order to determine the extension of the ore-body, its leases being riddled with drives, cross-cuts, winzes and bore-holes; therefore with the exception of small parallel pipes of stone there is apparently little prospect of a continuation of the ore-shoot being discovered.

Table showing the Yield of the Shenton Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896 ...	Lady Shenton, G.M.L. 2820z ...	1,749·00	5,833·92	3·34
1897 ...	Do. do. „	4,882·00	14,137·92	2·92
1898 ...	Do. do. „	7.828·00	20,090·48	2·73
1899 ...	Do. do. „	13,779·00	19,536·48	1·41
1900 ...	Do. do. „	16,341·00	17,552·40	1·08
1901 ...	Do. do. „	14,989·00	19,306·17	1·29
1902 ...	Do. do. „	15,900·00	17,508·18	1·10
1903 ...	Do. do. „	16,152·00	13,587·07	0·84
1904 ...	Do. do. „	1,119·00	675 87	0·60
1905 ...	Do. do. „	4,091·00	3,872·82	0·95
	Total	96,280·00	132,101·31	1·37

NOTE.—This reef should be credited with some 5,000 ozs. from the Florence and 10,000 ozs. from the Alpha, but no record of the exact quantity obtained from it is available.

The Menzies Alpha Leases, Ltd.—This property, which consists of the Stirling, G.M.L. 3031z, and the Alpha, G.M.L. 3011z, is situated immediately south of the Lady Shenton, but it was not until 1900 that the rich ore-shoot worked in that mine was found to extend into this property. Previous to this mining had been carried on upon the Stirling lease upon a reef which crossed the boundary about 160 feet from the north-east corner peg, which was supposed to be the extension of the Shenton reef; this now appears either to be the displaced continuation of the barren reef which lies to the eastward or upon the footwall side of it, or a pyrites lode which has been met with in the mine upon the hanging wall side. At the south end of this reef, which outcrops for a distance of about 300 feet, a vertical shaft, called Armstrong's shaft, has been sunk to a depth of 276 feet, which passed through the reef at 150 feet. At a depth of 205 feet a crosscut was driven 25 feet west, at which point it cut the reef and followed it for a distance of 40 feet. From the bottom of the shaft a crosscut was driven 110 feet to the eastward, but in it no lode was cut [**750, 754**].

A bore was then put down at the north-east corner peg, which cut the lode at a depth of 250 feet. A main shaft was sunk 123 feet south of this point to a depth of 335 feet, with a crosscut at 250 feet from which No. 1 level was driven, whilst No. 2 was driven from the bottom of the main shaft. (Plate V.)

In the No. 1 level the ore body extended south for a distance of 220 feet from the Shenton boundary, after which it died out, no continuation of it being discovered in the level which was continued for another 120 feet.

The No. 2 level was driven from the main shaft north to the boundary where the small terminal points of the shoot were met with; in places this also continued for 40 feet south of the shaft, after which no further ore was discovered, although 480 feet were driven in hard aphanatic diorite [**6330**].

In this level the last 300 feet were driven in a solid, barren quartz reef, which gradually formed and which is, in all probability, the same vein as was cut in the Armstrong shaft; however, no connection between these workings has yet been made.

From this level a considerable amount of crosscutting and boring has been done without result, whilst, from the bottom of the main shaft, a winze has been carried down on the dip of the formation for a further distance of 363 feet. From this winze a certain amount of boring and crosscutting has been done, which must, if the Shenton ore-shoot extended in this direction, have cut it, or, at least, some indication of it.

From this, it appears that the Shenton ore-shoots do not extend below the No. 2 level in this mine, which is the continuation of the No. 6 in the other, or, in other words, these veins cease to exist below the level to which the action of hydration has extended.

Upon the Alpha lease, which lies to the southward of the Stirling, a considerable amount of work has been done upon some small rich reefs that were met with near the south-east corner; one of these, which follows the general north-west course, has been worked by a number of underlay shafts to a depth of 60 feet, and, below this, by means of a winze to 100 feet. From this reef some rich stone was raised; but, since it is small, and the country hard below the existing workings, it has not been considered advisable to continue deeper. The line of the reef northward seems pretty constant, to judge by the number of prospecting shafts sunk upon it, but, immediately south, on approaching the Little Wonder, it is extremely broken, the dip changing even in a short distance.

Table showing the Yield of the Alpha Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896 ...	Menzies Alpha Leases—Stirling, G.M.L. 3031z, and Alpha, G.M.L. 3011z	53·00	324·55	6·12
1897 ...	Do. „ ...	427·00	1,164·70	2·72
1898 ...	Do. „ ...	263·00	1,431·52	5·44
1899 ...	Do. „ ...	199·00	559·35	2·81
1900 ...	Do. „ ...	200·50	239·37	1·19
1901 ...	Do. „ ...	676·50	822·42	1·21
1902 ...	Do. „ ...	3,853·00	4,020·76	1·04
1903 ...	Do. „ ...	4,746·50	6,015·21	1·26
1904 ...	Do. „ ...	343·50	476·27	1·38
1905 ...	Do. „ ...	311·00	483·59	1·56
	Total	**11,073·00**	**15,537·74**	**1·40**

The Alpha South, G.M.L. 3098z, is situated south of the Alpha, and was until quite recently held by the Menzies Mining and

Exploration Corporation, Ltd. Little work has been done upon it; the deepest shaft being 80 feet, from which 65 tons of stone were crushed, yielding 64·40ozs. of gold.

The Meriyulah, G.M.L. 4960z, is situated south of the Alpha South, and upon it some small quartz veins have been worked in the oxidised zone for the last six years.

Table showing the Yield of the Meriyulah Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1900 ...	Meriyulah G.M.L. 4960z	9·00	10·93	1·21
1901 ...	Do ,, ...	37·00	62·76	1·69
1902 ...	Do. ,, ...	23·00	30·18	1·31
1903 ...	Do. ,, ...	22·00	28·83	1·31
1904 ...	Do. ,, ...	107·00	91·12	·84
1905 ...	Do. ,, ...	107·00	120·13	2·05
	Total	**305·00**	**343·95**	**1·12**

The Heart's Content, G M.L. 4947z, is a small lease which lies to the south of the last, and was worked in the years 1900 and 1901, a shaft being sunk to a depth of 70 feet on a small quartz vein from which 44 tons of stone were raised which yielded 82·37ozs. of gold.

The Menzies Mining and Exploration Corporation, Ltd.—This Company owns a number of leases mentioned previously under their distinctive names, but this group of leases which constitute the head quarters of the Company consist of the Castle Blarney, G.M.L. 3106z; Lady Shenton East, G.M.L. 2843z; Lady Shenton Extended, G.M.L. 2844z; and Shenton South East, G.M.L. 4948z, all situated to the eastward of the Lady Shenton.

In the Extended, a small cross vein which strikes a little east of north, and dips to the south at an angle of 45 degrees has been worked by means of two underlay and one vertical shaft to a depth of 158 feet. From these levels have been driven at 62 feet, 200 feet long; at 99 feet, 200 feet long; and at 146 feet, 130 feet long, and from these workings 1,453 tons of stone were raised and crushed, yielding 1,157·47ozs. of fine gold.

On the Shenton East, an east and west reef consisting of two parallel pipes of stone have been worked to a depth of 199 feet by three underlay shafts with short levels and crosscuts, at 51 feet, 85 feet, 122 feet, 164 feet, and 199 feet. A main vertical shaft has also been started and sunk to a depth of 218 feet, but it has not yet been connected with the other workings on the lode. In this shaft, a supply of good stock water equal to 1,000 gallons per diem was cut at a depth of 155 feet. From this mine 1,770 tons of stone were crushed, which yielded 2,440·12ozs. of gold. The veins cut and worked in these two properties do not appear to be cross courses, but have simply been formed by the buckling of the strata.

The Shenton South-East, G.M.L. 4948z, is south of the Lady Shenton and Shenton Extended; it consists of portions of the Lady Shenton No. 1, G.M.L. 2824, and Lady Shenton South Extended, G.M.L. 3458z, the former of which was owned by the Menzies Gold Reefs Proprietary, Limited, who sank a shaft 100 feet and crosscut from the bottom 450 feet west in the hopes of cutting the Shenton lode; they also sank two shafts near the north boundary which are connected by a crosscut 150 feet long. With the exception of this, little work has been done upon this lease from which a parcel of 37 tons of stone was crushed, yielding 37·80ozs. of gold. Upon the Castle Blarney, which lies to eastward of the Extended and between it and the Railway, a few prospecting shafts have been sunk, the deepest of which is 50 feet.

The Golden Age or Little Wonder Group.—This group of leases cover, or at one time have covered, portions of the old leases Golden Age, G.M.L. 2,830z; Adelaide, G.M.L. 3378z; and Lady Shenton No. 1, G.M.Ls. 2424z and 3074z.

The Golden Age was worked in the earliest days of this field by the Menzies Golden Age Gold Mine, Limited, upon a small but rich east and west reef, the shoot in which dips to the south to the 80 feet level, beneath this, although considerable prospecting was done in serpentine schist, no continuation of the vein was met with. Five shafts were sunk, the total depth of which is 730 feet, the deepest being 260 feet, in which the water level was cut at 173 feet; besides these shafts 180 feet of winzing has been done, 1,470 feet of drives and crosscuts. The lode is apparently of the buckled type as there is no indication of a cross reef, the only outcrop being a large pyrites body which follows the normal course and is probably the same as cut to the northward in the Shenton No. 1.

In some portion of this mine the porphyritic granite dyke was cut out, and from these dumps a finer series of specimens were obtained illustrative of its gradual change into sericite schist **[6332-4]**. Portions of this lease have more recently been worked as the Federation, G.M.L. 4959z; and Golden Age, G.M.Ls. 5005z, and 5092z, whilst the Little Wonder also occupies a part.

Table showing the Yield of the Golden Age Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1896 ...	Menzies Golden Age, G.M.L. 2,830z	50·00	285·48	5·70	...	...	...
1897	Do.	202 50	722·20	3·56	...	..	...
1898	Do.				...		
1899 .	Do. ..	40·00	51·32	1·28	292·50	1,059·00	3·62
1900 .	Federation, G.M.L.4959z	30·00	13·19	·43	30·00	13·19	4·
1901 .	Golden Age, G.M.L. 5005z	31·00	27·75	·89		.	..
1902	Do. "	45·00	13·34	·29	76·00	41·09	·54
1903	Do. 5092z	27 00	46·69	1·73	...	...	..
1904	Do. "	10·00	1·96	·19		.	...
1905	Do. "	10·00	6 20	·62	47·00	54·85	1·17
	Total	...			445 50	1,168·13	2·62

The two leases named **Lady Shenton No. 1**—28247z and 3074z, which were owned by the Gold Reefs Proprietary, Limited, have, besides the Shenton South-East, G.M.L. 4948z, in the north, being divided up into the **Menzies Main Reef**, G.M.L. 5149z; **Golden Crown**, G.M.L. 4973z; **Hayles and Taverstocks United**, G.M.L. 5000z; **Little Wonder North**, G.M.L. 5171; and the balance of the **Little Wonder**, G.M.L. 5189z.

The original Company, besides the 450 feet and 150 feet of crosscutting mentioned previously, sank several shafts, in one of which a large pyrites lode assaying from two to three pennyweights was cut at 100 feet, being probably the same as that met with in the Golden Age, G.M.L. 2830z.

Upon these minor leases, as a rule, little has been done with the exception of raising a little stone from the old workings.

Table showing Yield of Gold from the above-mentioned Leases.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1904 ...	Menzies Main Reef, G.M.L. 5149z ...	37·00	10·00	·27
1901 ...	Golden Crown, G.M.L. 4973z	16·00	35·42	2·21
1901 ...	Hayles & Taverstock's United, G.M.L. 5000z	44·00	56·48	1·28
1902 ...	Hayles & Taverstock's United, G.M.L. 5000z	40·00	50·67	1·26
	Total	84·00	107·15	1·27

The Little Wonder, G.M.L. 5189z, is situated to the eastward of the Alpha South, G.M.L. 3098z, upon portion of what were the Shenton No. 1, G.M.L. 3074z, and the Golden Age, G.M.L. 3830z.

There are several lines of stone in this lease, but until recently most of the work was confined to the Golden Age and Central lines, lately, however, work has been started more to the westward, upon a promising ore body.

Table showing the Yield of the Little Wonder Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1903 ...	Little Wonder, G.M.L. 5139z	14·00	15·96	1·14	14·00	15·96	1·14
1904 ...	Do. G.M.L. 5168z	94·00	329·98	3·51	94·00	329·98	3·51
1904 ...	Do. G.M.L. 5189z	113·00	129·29	1·12	...	...	...
1905 ...	Do. G.M.L. 5189z	163·00	451·80	2·77	276·00	581·09	2·10
	Total	...	...	...	384·00	927·03	24·1

The Adelaide, G.M.L. 3378z, is an old lease which lies to the eastward of the Golden Age, and upon it a good many prospecting shafts have been sunk. Lately a portion of it has been worked as the Baden Powell, but so far only in the oxidised zone upon small quartz veins.

Table showing the Yield of the Baden Powell Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	Adelaide, G.M.L. 3378z	13·50	17·14	1·27
1903 ...	Baden Powell, G.M.L. 5089z	17·00	18·20	1·07
1904 ...	Do. 5241z	127·00	204·00	1·60
1905 ...	Do. „	19·00	8·63	·45
	Total	**176·50**	**247·97**	**1·40**

To the south and south-west of these are the **Cosmopolitan,** G.M.L. 4961z; **Broken Seal,** G.M.L. 5022z; and **Nugget,** G.M.L. 5209z, upon which a number of shallow workings have been sunk upon small quartz veins.

Table showing the Yield of the above-mentioned Leases.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1900 ...	Cosmopolitan, G.M.L. 4961z	42·00	18·13	·43
1901 ...	Do. „	10·00	5·58	·55
	Total	**52·00**	**23·71**	**·45**
1902 ...	Broken Seal, G.M.L. 5022z	35·00	25·66	·73
1904 ...	Nugget, G.M.L. 5209z	36·00	98·03	2·43
1905 ...	Do. „	51·00	46·89	·92
	Total	**122·00**	**170·58**	**1·39**

McClay's Welcome Gold Mining Company, N.L.—This Company, which owned Taipo, G.M.L. 3744z, and Taipo South, G.M.L. 3840z, which are situated to the southward of the Golden Age, worked these leases in 1897 and 1898 by means of a 62 feet north shaft from which a level was driven south from the bottom for a distance of 113 feet to the next shaft which is 132 feet deep with a level nine feet south at the 120 feet. The south shaft is on the northern boundary of the south lease and is 102 feet deep.

The vein in these workings is small and of low value, being associated with a porphyritic granite dyke [**6335**].

After the Company abandoned these leases, they have been held under the names of Golden Star, G.M.L. 4907z; Golden

Butterfly, G.M.L. 4997z; Welcome, G.M.L. 5101z; and Homeward Bound, G.M.L. 5173z, but little work has been done of a developmental character.

Table showing the Yield of McClay's Welcome Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs	ozs.
1897 ...	Taipo, G.M.L. 3744z ...	65·00	36·03	·54	...	...	.
1898 ...	Do.	17·00	12·74	·74	82·00	48·77	·59
1898 ...	Golden Star, G.M.L. 4907z	19·00	14·13	·74	19·00	14·13	·74
1901 ...	Golden Butterfly, G.M.L. 4997z	120·00	36·37	·30	120·00	36·37	·30
1904 ...	Welcome, G.M.L. 5101z	90·00	24·53	·27	90·00	24·53	·27
1904 ...	Homeward Bound, G.M.L. 5173z	33·00	4·82	·14	33·00	4·82	·14
	Total	...	...	...	344·00	128·62	·37

The Alexandria, or **Sherez,** G.M.L. 3098z, is situated at the north end of a parallel line of reef to the westward of the Lady Shenton. A few shafts have been sunk varying in depth from 60 to 100 feet, from which 171 tons of stone were raised, which yielded 201·40ozs. of gold.

The Africander, G.M.L. 5253z, is immediately south of the last mentioned, and upon it a great deal of shallow work has been done, small veins being apparently worked from the surface down in the oxidised zone and for considerable lengths. It has been worked off and on since 1898 either by companies or parties of working miners.

Table showing the Yield of the Africander Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1898 ...	Africander, G.M.L. 3034z	20·00	35·92	1·79			
1899 ..	Do. ,,	169·00	214·50	1·21	189·00	250·42	1·32
1900 ...	Do. ,,						
1901 ...	Do. ,,						
1902 ...	Do. 4984z	42·00	40·62	·96			
1903 ...	Do. ,,	5·0	15·72	3·14	47·00	56·34	1·19
1904 ...	Menzies Fortuna, G.M.L. 5136z	118·00	118·81	1·00			
1905 ...	Do. ,,	19·00	20·93	1·10	137·00	139·74	1·09
1905 ...	Africander, G.M.L. 5253z	34·50	38·09	1·10	34·50	38·09	1·10
	Total	...		.	407·50	424·59	1·19

The London and Coolgardie Explorers, Ltd.—This company owned the Last Chance, G.M.L. 3116z, and Mersey, G.M.L. 3118z, which lie immediately south and east of the Africander, and upon this a good deal of shallow sinking along the course of small ore bodies has been carried on for a number of years.

Table showing the Yield of the London and Coolgardie Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1898 ...	Last Chance, G.M.L. 3116z	110·00	218·88	1·98
1899 ...	Do. „	204·50	150·58	·73
1901 ...	Do. „	10·00	12·14	1·21
1902 ...	Do. „	16·00	12·63	·78
1903 ...	Do. „	31·50	53·97	1·71
1904 ...	London and Coolgardie, G.M.L. 5013z	12·00	6·78	·56
	Total	**383·00**	**454·98**	**1·19**

The Crown Cross Group.—South of the last mentioned, and upon the same line of country, is the Crown Cross, G.M.L. 4912z, upon which a long line of reefs appears to have been worked by a series of shafts to a depth of about 100 feet. One shaft has been sunk to a depth of 200 feet, which is the water level.

The other leases of this group to the southward also appear to have been continuous lines of reefs, to judge from the old workings.

Table showing the Yield of the Crown Cross Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897 ...	Crown Cross, G.M.L. 4860z	11·00	9·34	·84
1898 ...	Do. „	223·00	172·32	·77
1899 ...	Do. G.M.L. 4912z	60·00	160·22	2·67
1900 ...	... ...	111·00	346·54	3·09
1901 ...	... ...	182·00	455·01	2·50
1902 ...	... ...	11·00	8·43	·76
1903 ...	... ...	146·00	399·48	2·73
1904 ...	... ...	66·50	104·53	1·57
1905 ...	... ...	18·00	10·82	·60
	Total	**825·50**	**1,666·69**	**2·01**
1900 ...	Ivy, G.M.L. 4942z	15·00	1·58	·10
1901 ...	Crown Cross South Extended, G.M.L. 4979z	101·00	498·01	4·53
1902 ...	Westralia Menzies, G.M.L. 5084z ...	...	5·75	...
1903 ...	Do. „ ...	·50	92·66	184·12
1904 ...	Do. „ ...	20·00	32·56	1·14
	Total	**136·50**	**630·56**	**5·17**
1900 ...	Nil Desperandum, G.M.L. 4941z ...	74·00	152·55	2·06
1901 ...	Do. „ ...	13·00	43·22	3·32
1904 ...	Victoria Cross, G.M.L. 5131z	32·00	7·48	·23
	Total	**119·00**	**203·25**	**1·70**

The Warrior, G.M.L. 3048z.—This lease was worked and owned by the Warrior Menzies G.M. Co., N.L. (late Wallaroo Menzies G.M. Co., N.L.), which Company also owned the Gem, G.M.L. 3235z, and the Monte Christo Battery, on G.M.L. 3398z.

There are three lines of lode upon this property, called respectively the main lode and the eastern and western.

The main lode was first opened upon by an underlay shaft 115 feet deep, from the bottom of which a level was driven 280 feet south, the lode being about four feet in thickness. [**751, 755, 6371.**]

A main vertical shaft was sunk about 200 feet to the westward of the underlay shaft to a depth of 200 feet without cutting water. At 100 feet from the surface a crosscut was driven east 130 feet, which cut the level 100 feet south of the underlay shaft. From this level a winze was put down 60 feet at a point 50 feet south of the crosscut.

At the 200 feet level a crosscut has been driven 75 feet east, which cut the lode, the latter being driven on for a distance of 70 feet south. A winze was sunk from this level at a point 10 feet south of the crosscut to a depth of 30 feet, the stone being about four feet six inches thick.

On the western lode there are three shafts—a vertical 110 feet, one underlay 80 feet, and one 115 feet with 272 feet of drives. Most of the work has been confined to the upper levels, where the lode was from two feet to two feet six inches in thickness, but a little has been done at 110 feet, where it is three feet six inches thick.

On the eastern reef an underlay shaft has been sunk 75 feet and a level driven 90 feet, in which the stone is three feet in thickness. Another shaft has been sunk on the line of this lode to cut it at 129 feet, but it is only down 90 feet at present.

A considerable amount of stoping has been done from the various levels, whilst the quantity of stone raised and crushed is given in the following table:—

Table showing the Yield of the Warrior Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1898 ...	Warrior Menzies, G.M.L. 3048z ...	200·00	184·89	·92
1899 ...	Do. „ ...	212·00	119·48	·56
1900 ...	Do. „ ...	298·00	200·88	·67
1901 ...	Do. „ ...	340·00	161·73	·47
1902 ...	Do. „ ...	80·00	39·13	·48
1903 ...	Do. „ ...	23·00	22·95	·99
1903 ...	Warrior, G.M.L. 3048z	205·00	205·21	1·00
1904 ...	Do. „	344·00	172·26	·50
1905 ...	Do. „	101·00	41·02	·40
	Total	**1,803·00**	**1,147·55**	**·64**

The Indus, G.M.L. 4291z; **Opal,** G.M.L. 5100z; **Battlers' Rest,** G.M.L. 5143z; and **Lucky Prop,** G.M.L. 5127z, were small leases situated to the south of the Warrior, upon which a little work was done.

Table showing the Yield of the above-mentioned Leases.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	Indus, G.M.L. 4291z	16·00	2·76	·17
1904 ...	Opal, G.M.L. 5100z	30·00	4·71	·15
1903 ...	Battlers' Rest, G.M.L. 5143z	10·00	12·97	1·29
1904 ...	Do. „	11·00	5·06	·46
	Total	67·00	25·50	·38
1903 ...	Lucky Prop, G.M.L. 5127z	72·00	17·96	·24

The Lady Harriet Leases, G.M.Ls. 4972z and 5003z.—This area was owned by the Menzies Pioneers, Ltd., which Company held it until 1898, since which time it has been owned locally.

At one time there appears to have been a considerable amount of dryblowing carried on upon this lease, whilst to the westward a large number of shafts have been sunk, apparently upon an alluvial lead, but no record appears to exist with regard to the quantity of gold obtained.

The original Company did a very considerable amount of shaft-sinking, driving, and crosscutting on this property upon a line of lode which strikes about 35 degrees west of north, and dipping to the southward at varying angles, though usually steep. The ore occurred in pipes or shoots, and is pretty well worked out in the upper levels.

The deepest shaft is 200 feet, and in this salt water was struck at a depth of 160 feet (the water level is now 188 feet).

Recently the Lady Shenton Gold Mines, Ltd., took an option on this property when, according to the manager's report, a large quantity of sinking, driving, and crosscutting was done below the existing workings. In summing up the situation, Mr. Falconer, the manager, says:—"Payable stone had been crushed, and was then showing in four different shoots. The shoot at No. 1 shaft has been proved to be non-existent at the 187 feet level over a length of 229 feet. The shoot in the No. 2 shaft has been proved to have a total length of 110 feet at the 40 feet level, and 26 feet at the 100 feet level, and an average value of 10dwts. The shoot in No. 3 shaft has not been completely explored, but, judging from the work already done, is very probably only a short pipe. The shoot in No. 4 shaft has been proved at the 187 feet level to have a length of 20 feet, a width of five feet, and an average value of 30dwts." *

Even at the moderate depth of 187 feet, where most of this work was carried out, the country was so hard as to necessitate the use of rock drills. It will be seen from the above that the lodes here are of a similar character to those further north, *i.e.*, rich pipes of ore which decrease in size and die out as they approach the hard country.

At the south-east end of this line of reef, a cross reef from the outcrop of which the dryblowing patch starts; this latter has been worked both in this lease and in that adjoining, called the Olivia, from which it is named. The reef strikes in a north-easterly direction, and dips to the north-west; its junction with the Harriet Reef in all probability feed the alluvial patch.

Table showing the Yield of the Lady Harriet Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1897 ...	Lady Harriet, G.M.L. 2822z (Menzies Pioneers, Ltd.)	613·00	689·40	1·12			
1898 ...	Do.	...	28·43	...	613·00	717·83	1·17
1899 ...	Lady Harriet, G.M.L. 2822z	334·00	280·74	·84			
1900 ...	Do. ...	425·00	364·71	·85	759·00	645·45	0·88
1901 ...	Lady Harriet, G.M.L. 4972z	320·00	241·98	·75			
1902 ...	Do. ...	295·00	472·75	1·60			
1903 ..	Do. ...	112·00	405·85	3·62			
1904 ..	Do. ...	631·00	474·09	·75			
1905 ...	Do. ...	819·00	488·71	·59	2,177·00	2,083·38	·95
	Total ...	...	...	...	3,549·00	3,446·66	·97

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* Report to the directors of the Lady Shenton Gold Mine, Limited.

To the south of the Lady Harriet there are several small properties upon which a little work has been done, which have yielded the following returns:—

Table showing the Yield of the Reefs south of the Lady Harriet.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1898 ...	Ourine, G M.L. 4877z	33·00	22·83	·76
1898 ...	Jimgellie, G.M.L. 4877z	42·00	28·78	·68
1898 ...	Three Battlers, G.M.L. 4871z ...	57·00	40·09	·72
1902 ...	Coronation Gift, G.M.L. 5064z ...	29·00	22·25	·77
	Total	**86·00**	**62·34**	**·72**
1901 ...	Home Signal, G.M.L. 4993z	5·00	4·94	·98
1903 ...	Great Hope, G.M.L. 5090z	12·50	21·85	1·74
	Total	**17·50**	**26·79**	**1·52**
1897 ...	Daisy Bell, G.M.L. 4061z	49·00	47·11	·96
1898 ...	Do. „	23·00	22·23	·96
1903 ...	Bellinger, G.M.L. 5114z	2·00	·28	·14
1904 ...	Do. „	29·00	8·74	·30
	Total	**103·00**	**78·36**	**·76**
1898 ...	Ancient Britain Extended, G.M.L. 4007z	**26·00**	**20·79**	**·78**

The Maori Chief, G.M.L. 4987z; the **Sefton**, G.M.L. 5080z, or **Double Event**, G.M.L. 5135z; and the **Eureka**, G.M.L. 5078z, are situated upon the eastern side of the Railway Line to the eastward of the Golden Age, G.M.L. 2830z.

Little has been done on these, with the exception of the Maori Chief, G.M.L. 4987z, the workings on which consist of a main shaft 96 feet deep, from which a crosscut has been driven at the 70 feet level 33 feet east to a level which is 110 feet long, which is also connected with the surface by a vertical and an underlay shaft.

The ore-shoot, which dips south, and is about 18 inches wide has been driven upon for 65 feet in the southern portion of this level; it has been worked up to the surface and is now being followed down by the means of winzes.

Table showing the Yield of the Maori Chief and other Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	Maori Chief, G.M.L. 4914z	7·00	9·27	1·32
1900 ...	Do. „	296·00	209·14	·73
1901 ...	Do. 4987z	90·00	44·90	·49
1902 ...	Do. „	74·00	88·51	1·19
1903 ...	Do. „	...	...	...
1904 ...	Do. „	96·00	74·28	·74
1905 ...	Do. „	283·00	266·99	·94
	Total	**543·00**	**474·68**	**·87**
1903 ...	Sefton, G.M.L. 5080z	8·10	12·66	1·56
1904 ...	Double Event, G.M.L. 5135z	36·00	44·15	1·22
1905 ...	Do. „	38·00	17·05	·34
	Total	**82·10**	**73·86**	**·89**

The Menzies Lady Mary, G.M.L. 3121z, lies a few chains to the eastward of the last, and from it 14 tons of stone were crushed in 1897, which yielded only 1·22 ounces of gold. The balance of the stone, which is of a ferruginous character, is still at grass. [792, 793, 798.]

Miscellaneous Leases.

Upon the western side of the Railway Line, and running towards it and eventually crossing it, is a line of scattered leases upon which a considerable amount of development work was done in places by Companies during the boom time, but since their abandonment they have been worked by prospectors in a desultory manner.

This line starts at the northern end with the Olive Branch, G.M.L. 5112z, which is situated upon the side of an immense barren quartz blow, forming a portion of the dividing ridge between the northern and south-western watershed. South of this lie the two leases, both named the Lincoln, G.M.Ls. 5134z, 5181z; then the Lady Sarah, G.M.L. 5009z, afterwards called the Lady Fanny, G.M.L. 5179z; then the Queenslander, G.M.L. 5126z; and Two Walters, G.M.L. 5207z.

Next, upon a steep laterite hill to the east of the Lady Harriet, G.M.L. 4972z, are the old leases formerly known as the Monte Christo, G.M.L. 3398z; and Gem, G.M.L. 3235z, which were owned by the Warrior Menzies Company (late Wallaroo). This Company did a considerable amount of work upon them, but, apparently, did not succeed in discovering a payable lode. A battery was, however, erected on the ground, and a water supply obtained by sinking, the stone crushed coming from the Warrior, G.M.L. 3048z.

These leases have since been held as the Sailor, G.M.L. 5109z; Bristol, G.M.L. 5116z; Busy Bee, G.M.L. 5105z; and Adelaide, G.M.L. 5128z; but have, apparently, never yielded rich stone. On the **Gem Extended**, G.M.L. 4957z, now the **Menzies Star**, G.M.L. 5118z, a number of shafts have been sunk upon a vein of the usual type, which has been worked in the oxidised zone since 1897 by various parties.

South of this, again, are the **Lucky Venture**, G.M.L. 5151z, and **Lord Nelson**, G.M.L. 5111z; and to the south-west of these the **Klondyke**, G.M.L. 5226z; the **Great Klondyke**, G.M.L. 4853z; the **Britannia**, G.M.L. 4850z; the **Hornet's Nest**, G.M.L. 4998z; and the **Golden Horseshoe**, G.M.L. 4990z; whilst to the eastward of the railway line are the **Lucky Hit**, G.M.L. 5137z, or **Lucky Strike**, G.M.L. 5194z; the **Never Despair**, G.M.L. 5225z; the **Ballarat Menzies**, G.M.L. 5113z; the **Just-in-Time**, G.M.L. 4886z; the **Sophia**, G.M.L. 5233z; the **Black and White**, G.M.L. 4978z; the **Guiding Star**, G.M.L. 4951z; and the **Columbia**, G.M.L. 5104z.

Table showing the Yield of Miscellaneous Leases.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1904 ...	Olive Branch, G.M.L. 5112z	**40·00**	**8·29**	**·20**
1904 ...	Lincoln, G.M.L. 5184z	**31·00**	**71·75**	**2·31**
1904 ...	Lincoln, G.M.L. 5181z	37·00	59·17	1·54
1905 ...	Do. „	24·00	47·25	2·71
	Total	**61·00**	**106·42**	**1·74**
1901 ...	Lady Sarah, G.M.L. 5009z	40·00	48·17	1·20
1902 ...	Do. „	60·00	74·34	1·23
1903 ...	Do. „	38·00	5·46	·14
1904 ...	Lady Fanny, G.M.L. 5179z	16·00	10·09	·63
	Total	**154·00**	**138·06**	**·89**
1903 ...	Queenslander, G.M.L. 5126z	28·00	16·10	·57
1904 ...	Do. „	8·00	4·25	·53
	Total	**36·00**	**20·35**	**·56**
1904 ...	Two Walters, G.M.L. 5207z	30 00	10·78	·35
1905 ...	Do. „	50·00	20·00	·40
	Total	**80·00**	**30·78**	**·38**
1897 ...	Monte Christo and Gem, G.M.Ls. 3235z, 3398z	12·00	2·42	·20
1903 ...	Sailor, G.M.L. 5109z	...	·59	...
1903 ...	Bristol, G.M.L. 5116z	12·00	4·64	·38
1904 ...	Do. „	14·00	3·06	·22
1903 ...	Busy Bee, G.M.L. 5105z	46·00	20·87	·45
1904 ...	Do. „	161·00	59·90	·37
1904 ...	Adelaide, G.M.L. 5128z	109·00	52·02	·47
	Total	**354·50**	**143·50**	**·40**

Table showing the Yield of Miscellaneous Leases—continued.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897 ...	Gem Extended, G.M.L. 4849z... ...	52·00	25·95	·49
1898 ...	Do. do. „	52·00	21·08	·40
1899 ...	Do. do. „	19·50	8·14	·42
1900 ...	Do. do. 4957z... ...	15·00	6·33	·42
1902 ...	Do. do. 5015z... ...	15·00	6·92	·46
1904 ...	Menzies Star, G.M.L. 5118z	94·00	55·68	·59
1905 ...	Do. do. „	20·00	6·41	·32
	Total	**267·50**	**130·51**	**·49**
1904 ...	Lucky Venture, G.M.L. 5151z ...	**45·00**	**9·49**	**·21**
1902 ...	Lord Nelson, G.M.L. 5021z	**12·00**	**4·55**	**·37**
1897 ...	Great Klondyke, G.M.L. 4853z ...	16·80	36·94	2·20
1903 ...	Klondyke, G.M.L. 5132z	16·00	6·33	·39
1904 ...	Do. „	15·00	2·04	·13
1905 ...	Do. „	52·00	11·72	·22
	Total	**83·00**	**20·09**	**·24**
1898 ...	Britannia, G.M.L. 4850z	**8·00**	**2·74**	**·34**
1901 ...	Hornet's Nest, G.M.L. 4998z	**5·00**	**1·68**	**·33**
1901 ...	Golden Horseshoe, G.M.L. 4990z ...	**20·00**	**7·31**	**·36**
1903 ...	Lucky Hit, G.M.L. 5187z	5·00	9·75	1·95
1904 ...	Do. „	35·00	5·49	·15
1904 ...	Lucky Strike, G.M.L. 5194z	36·00	5·10	·14
	Total	**76·00**	**20·34**	**·26**
1905 ...	Never Despair, G.M.L. 5225z	**81·00**	**42·10**	**·50**
1898 ...	Just in Time, G.M.L. 4886z	24·00	12·04	·50
1903 ...	Ballarat Menzies, G.M.L. 5113z ...	25·75	12·22	·47
1904 ...	Do. „ ...	39·00	5·84	·15
1904 ...	Just in Time, G.M.L. 5141z	25·00	4·08	·62
	Total	**113·75**	**34·18**	**·30**
1905 ...	Sophia, G.M.L. 5233z	**113·00**	**79·34**	**·70**
1901 ...	Black and White, G.M.L. 4978z ...	62·00	26·56	·44
1902 ...	Do. „ ...	20·00	9·00	·45
	Total	**82·00**	**35·56**	**·43**
1900 ...	Guiding Star, G.M.L. 4951z	48·00	33·74	·70
1901 ...	Do. „	200·35	220·92	1·11
1902 ...	Do. „	23·00	13·60	·59
1904 ...	Columbia, G.M.L. 5104	18·00	9·86	·55
	Total	**289·35**	**278·12**	**·93**

The Craig-y-nos, G.M.L. 5250, is situated upon the eastern side of the Railway Line and north of the township of Woolgar; it has repeatedly changed hands, but in no instance has it been held for long.

A considerable amount of developmental work was done upon it by the W.A. Venture Corporation, who held it in 1897, and who sank two shafts—one 100 feet, and one 150 feet—with 500 feet of drives. Owing to the fact that it has so often changed hands, no systematic work has been carried out, and in consequence no opinion as to the character of the lode can be formed.

Table showing the Yield of the Craig-y-nos Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total. Ore crushed.	Total. Gold therefrom.	Average rate per ton.
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1897 ..	Nick of Time, G.M.L. 3205z	177·50	113·17	·63	117·50	113·17	·63
1898 ..	Athelstane, G.M.L. 4873z	362·00	171·77	·47			
1899 .	Do. ,,	96·00	32·73	·34	458·00	204·50	·45
1900 ..	Craig-y-nos, G.M.L. 4940z	318·00	264·61	·83			
1901 ..	Do. ,,	208·75	85·30	·40	527·25	349·91	·66
1902 ..	Perseverance, G.M.L. 5102z.	98·00	29·52	·30	98·00	29·52	·30
1903 ...	Craig-y-nos, G.M.L. 5220z	220·00	88·15	·40	220·00	88·15	·40
	Total	...	...	...	1,420·75	785·25	·53

The Menzies Gift, G.M.L. 3036z, and The Gift, G.M.L. 4916z, which adjoins it, are situated a little south of Woolgar, and mining was evidently started here on the strength of their position at the head of an alluvial run which extended from them to a little beyond the Telegraph line in a westerly direction. Of the latter there are no records nor returns, whilst the reefs worked proved of too low a grade to be payable. From the former of these 50·00 tons of stone were crushed, which yielded 12·74ozs. of gold, and from the latter 10·00 tons, which yielded 5·37ozs. of gold.

The Barunga Brave, G.M.L. 4691z, is situated about 2½ miles south. It has not been worked since 1898, up to which date 23 tons of stone were crushed, which yielded 19·72ozs. of gold [**1185, 1189**].

The Black Horse, G.M.L. 5106z, and Storm King, G.M.L. 5176z, are situated upon a low ridge about one mile to the eastward of Woolgar. A small patch of alluvium was worked in a little gully crossing the former, which terminated at a small quartz vein which is now being worked.

Table showing the Yield of the Black Horse Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1903 ...	Black Horse, G.M.L. 5106z	...	22·79	...
1904 ...	Do. „	140·00	181·81	1·29
1905 ...	Do. „	76·00	45·71	·60
	Total	216·00	250·31	1·16

The Black Jack, G.M.L. 4879z, is situated to the southward of the last, being a portion of what was originally the Lady Main, and upon it four shafts have been sunk, the deepest being 187 feet, in which the water level is 170 feet from the surface. The reef varied from eight inches to three feet in width with six to eight feet of formation. The course of the shoot, which was 100 feet wide, is a little west of north with a southerly dip, but it dies out below the 130-feet level. The vein is of the lenticular type, and decreases in size and value with depth.

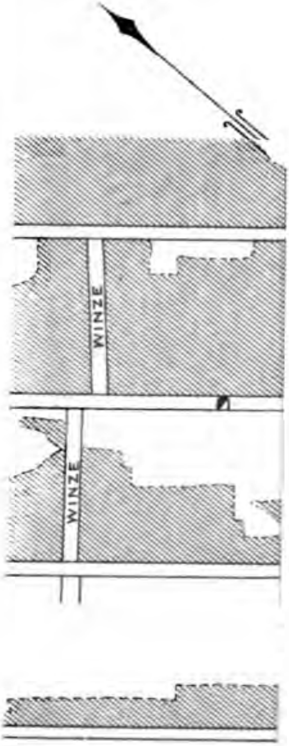
Table showing the Yield of the Black Jack Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897 ...	Lady Main, G.M.L. 3963z	95·00	112·65	1·19
1898 ...	Black Jack, G.M.L. 4879z	50·00	94·79	1·89
1899 ...	Do. „	190·00	314·42	1·65
1900 ...	Do. „	306·00	470·00	1·54
1901 ...	Do. „	113·00	99·54	·88
1902 ...	Do. „	120·00	62·74	·52
1903 ...	Do. „	10·00	9·60	·96
1904 ...	Do. „	150·00	35·60	·24
1905 ...	Do. „	12·00	9·28	·77
	Total	1,056·00	1,209·18	1·14

The Lone Hand, G.M.L. 5230z, lies a little west of the latter, and from it 37 tons of stone yielded 34·47 ounces of gold.

The Menzies Consolidated Gold Mine, Ltd.—This Company own a number of leases situated upon the western side of the railway line close to the township of Woolgar.

The main workings are situated upon the Princess May South, G.M.L. 4935z, but extend northward into the Princess May, G.M.L. 4934z. The line of reef, however, has been traced in a north-west direction for over 1,000 feet into the Princess Eva, G.M.L. 981z, where another series of old workings are located. On the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Princess May South, a main shaft has been sunk to a depth of 425 feet, which cuts the reef between the No. 1 and No. 2 levels, below which crosscuts connect it with the various levels, the No. 5 level at the bottom being 170 feet distant. Owing to the distance from the lode being so great, the shaft was not continued, but a main haulage winze carried down from the No. 5 at a point about 100 feet further south, by means of which the mine was worked to the No. 9 or 688-feet level, but since the ore-shoot had dipped to the southward of this, another winze has been sunk still further south from the bottom level, which has now reached a vertical depth below the surface of over 800 feet; this is therefore considerably the deepest mine in Menzies. (Plate VI.)

The ore in this mine has proved in the nine levels to average about 400 feet in horizontal length with a dip of about 36 degrees south upon the plane of the lode, which dips 57 degrees south-west, the total length of the proved ore-shoot from the surface to the bottom of the mine being over 1,600 feet, whilst the thickness is so variable that it is impossible to state it but it must average three feet.

The lode is clearly of the true fissure type having an extremely well-defined and striated footwall, whilst the hanging wall is more or less broken by feeders. In the levels above No. 6 a parallel lode has been worked which had a strike more to the westward, this, however, took a turn between Nos. 5 and 6 more to the northward than the main ore body with which it would appear to junction further north. The main ore-shoot in this mine appears if anything to gain in width and definition with depth, whilst in the north drive at the No. 9 level, the vein was found to continue and carry gold for a distance of over 800 feet, it being poor near the winze but improves towards the end. This may be another shoot or the continuation of one that was prospected at the surface farther north.

At the bottom of the winze the lode is highly mineralised, carrying large quantities of Pyrrhotite (magnetic pyrites) [6314] whilst the gold value still keeps up, the vein being over six feet in thickness and as well defined as at any part of the mine.

In the northern workings upon the Princess Eva a main shaft has been sunk and the lode worked to a depth of over 200 feet, but owing to very considerable faulting these workings were abandoned and the shaft is now used as a water shaft.

Water containing 2·8 per cent. of solid matter was cut at a depth of 130 feet, which yielded originally 30,000 gallons per diem this, however, has considerably diminished whilst after passing through the zone of saturation, the formation is practically dry. [1047-52.]

Table showing the Yield of the Menzies Consolidated Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897 ...	Princess May and Princess May South, G.M.Ls. 4934z and 4935z ...	6,525·0	5,456·13	·83
1898 ...	Do. do. ...	6,969·0	5,702·80	·82
1899 ..	Do. do. ...	7,617·0	6,978·04	·92
1900 ...	Do. do. ...	6,589·0	5,936·89	·90
1901 ...	Do. do. ...	10,489·0	6,817·49	·65
1902 ...	Do. do. ...	12,795·0	7,535·36	·59
1903 ...	Do. do. ...	16,096·0	8,341·31	·52
1904 ...	Do. do. ...	14,657·0	8,972·58	·61
1905 ...	Do. do. ...	17,634·0	10,134·44	·59
	Total	**99,371·0**	**65,875·05**	**·66**

The **Goodenough**, G.M.L. 4855z, is situated about three miles in an east-north-east direction from Menzies, and lies at the extreme north of the Kensington Group; it has recently been acquired by the Queensland Menzies G.M. Co., N.L.

A line of lode can be traced at the surface in an east and west direction for a distance of about 600 feet lying parallel to an outcrop of sericite schist, which is apparently a dyke, whilst to the south it dips into a solid diorite hill. [**6337, 6340, 6364.**]

Five underlay shafts, the deepest of which is 240 feet, have been sunk upon this lode, which dips at an angle of from 25 to 30 degrees south. Levels have been driven at the 100 feet (55 feet vertically below the surface) and 180 feet (80 feet vertical depth, or at the water-level) upon a body of stone varying from three to six feet in thickness. A dislocation in the lode was met with in the 100-feet level a little north of the No. 2 shaft, beyond which a branch vein appears to have been followed. The main lode however was picked up to the northward and opened upon near the mouth of the No. 1 shaft by means of first an opencut and then a winze which was carried down to the 100-feet level.

In the opencut the reef is large and solid, and yielded very good returns, but suddenly came to an end upon what is probably a fault; but it is too near the surface to determine this point with any degree of certainty.

This lode is very highly ferruginous in places, being literally one mass of pyrites, whilst specimens of chloride of silver have also been met with.

All the developments so far have been carried on in the oxidised zone, where the rock is soft and of a yellow argillaceous nature; in consequence it affords little evidence as to its original character. So far the stone crushed has been of good quality, but the gold is of very low value.

There is a good supply of fresh water in a well a little north of the outcrop said to have yielded 2,000 gallons per diem, whilst the water in the mine makes at the rate of about 600 gallons.

Table showing the Yield of the Goodenough Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897 ...	Goodenough, G.M.L. 4855z	125·00	104·82	·83
1898 ...	Do. „	167·50	264·11	1·57
1899 ...	Do. „	390·55	564·34	1·44
1900 ...	Do. „	322·50	380·05	1·17
1901 ...	Do. „	852·40	1,314·33	1·55
1902 ...	Do. „	694·00	1,671·57	2·40
1903 ...	Do. „	518·00	603·05	1·16
1904 ...	Do. „	361·00	276·09	·76
1905 ...	Do. „	1,017·00	1,042·80	1·02
	Total	**4,447·95**	**6,220·66**	**1·39**

To the eastward and southward of the Goodenough are the following leases, upon which little work has been done:—

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1898 ...	Golden Shoe, G.M.L. 4861z	**44·00**	**51·36**	**1·17**
1902 ...	Coronation, G.M.L. 5041z	**10·00**	**8·39**	**·84**
1905 ...	Little Vic or Anti Daglish, G.M.L. 5225z	**17·50**	**29·73**	**1·70**

Miscellaneous Leases.

On the Four o'Clock, G.M.L. 5072z, which lies to the south-west, a small reef with a north-east south-west course and dipping south-east has been worked to a shallow depth for a length of five chains, whilst on the Resurgam, G.M.L. 5117z, which apparently lies upon the same line, the reef has been traced for a length of

10 chains but has only been worked for a length of 80 feet and to a depth of 30 feet, the average size being three inches.

Table showing the Yield of the Four o'Clock and Resurgam Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons	ozs.	ozs.
1901 ...	Four o'Clock, G.M.L. 5012z	10·00	10·90	1·09
1902 ...	Do. „	45·00	20·41	·45
1902 ...	Do. 5072z	18·00	20·23	1·12
1903 ...	Do. „	35·00	45·71	1·30
1904 ...	Do. „	20·00	4·00	·20
	Total	**128·00**	**101·25**	**·79**
1902 ...	Resurgam, G.M.L. 5076z	10·00	9·02	·90
1903 ...	Do. „	11·00	20·67	1·88
1903 ...	Do. 5117z	10·00	4·68	·46
1904 ...	Do. „	5·00	4·74	·95
	Total	**36·00**	**39·11**	**1·09**

To the eastward of the last and south of the Goodenough are **Brown Hill**, G.M.L. 4949z, the **Rising Sun**, G.M.L. 5040z, and **Christmas Gift**, G.M.L. 5016z; whilst the **Danae**, G.M.L. 5050z, and **Blaas Reward**, G.M.L. 5025z, lie to the south-west on the flat, and the **Industria**, G.M.L. 4899z, south along the range.

Table showing the Yield of Miscellaneous Leases.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1900 ...	Brown Hill, G.M.L. 4049z	15·00	9·19	·57
1901 ..	Do. „	16·00	5·72	·39
	Total	**31·00**	**14·91**	**·48**
1902 ...	Rising Sun, G.M.L. 5040z	**10·00**	**10·03**	**1·00**
1902 ...	Christmas Gift, G.M.L. 5016z ...	**93·00**	**83·86**	**·90**
1902 ...	Blaas Reward, G.M.L. 5025z	**23·00**	**17·64**	**·77**
1902 ...	Danae, G.M.L. 5050z	**10·00**	**3·89**	**·38**
1899 ...	Industria, G.M.L. 4899z	**44·80**	**14·94**	**·34**

The True Blue, G.M.L. 3822z, now known as the Picton, G.M.L. 4985z, was worked from 1899 to 1901 by the W.A. Proprietary Company, who in sinking a main shaft struck a supply of 1,300 gallons per diem of fresh water at a time when water was particularly scarce in Menzies. Several shafts have been sunk upon this property in which a large low-grade formation was cut which strikes in a north-east and south-west direction, dipping at a low angle to the south-east, but of this only the quartz-veins in the upper levels have been worked.

Table showing the Yield of the Picton Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	True Blue, G.M.L. 3322z	100·00	24·05	·24
1901 ...	Do. "	56 00	14·59	·26
1901 ...	Picton, G.M.L. 4985z	50·00	19·94	·40
1904 ...	Do. "	177·50	51·61	·40
1905 ...	Do. "	143·00	27·52	·19
	Total	**526·50**	**137·71**	**·26**

Between the Picton and the Kensington there have been a number of leases which have been worked upon a series of lenticular quartz-veins which strike north-east and dip south-east. These start with the True Blue South, G.M.L. 4923z, which later on was called the Lord Roberts, G.M.L. 5168z, in which a body of stone four feet wide was worked for a length of 200 feet and to a depth of from 40 to 50 feet.

Table showing the Yield of the True Blue South Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	True Blue South, G.M.L. 4923z ...	44·00	22·48	·51
1900 ..	Do. " ...	7·00	31·93	4·56
1901 ...	Lord Roberts, G.M.L. 5007z	39·00	27·40	·70
1902 ...	Do. "	30·00	10·69	·35
1903 ...	Do. 5168z	26·00	7·06	·27
	Total	**146·00**	**99·56**	**·68**

The Kensington Vindicator, G.M.L. 3615z, was originally worked as a whole by a Company, but later the northern portion was taken up as the Alexandra, G.M.L. 4918z, and later on as the

Butterfly, G.M.L. 4992z. On this ground a lode has been worked for a length of 200 feet, the quartz averaging about 12 inches down to the 50-feet level. A shaft has been sunk to a depth of 135 feet, which cut a supply of stock water yielding about 50 gallons per diem.

Table showing the Yield of the Butterfly Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1898 ...	Kensington Vindicator, G.M.L. 3615z	26·00	45·60	1·75
1899 ...	Do. "	7·00	2·10	·30
1899 ...	Alexandra, G.M.L. 4918z	15·00	19·24	1·28
1900 ...	Do. "	82·00	136·52	1·90
1901 ...	Do. "	6·00	16·13	2·69
1901 ...	Butterfly, G.M.L. 4992z	25·00	54·96	2·19
1902 ...	Do. "	33·00	72·07	2·19
1903 ...	Do. "	16·00	29·24	1·82
1904 ...	Do. "	23·50	10·93	·47
	Total	**233·50**	**386·79**	**1·65**

Upon the southern portion of this, which was afterwards called the Vindicator South, G.M.L. 4924z, and later the Little Tom, G.M.L. 5083z, a small vein of stone about 8 inches wide has been opened up to a depth of 60 feet. This vein on its southward course gradually loses its easterly dip, turning flat with a slight southerly dip, then tilting over to the west.

Table showing the Yield of the Little Tom Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	Vindicator South, G.M.L. 4924z ...	9·00	7·56	·84
1900 ...	Do. " ...	20·00	25·27	1·26
1902 ...	Little Tom, G.M.L. 5083z	7·00	12·51	1·79
1903 ...	Do. "	18·00	27·98	1·55
	Total	**54·00**	**73·32**	**1·35**

Upon the Menzies Kensington, G.M.L. 3277z, which adjoins the last, to judge from the large cavern-like excavation a large lenticular body of quartz with a southerly dip was worked, the extension of which has not been cut in any of the shafts either to the dip or on the strike. A number of vertical shafts have been sunk, one 125 feet (which is the water-level), and another 100 feet, whilst an underlay has been sunk 70 feet and 400 feet of driving, but in these no stone of any value was cut.

Table showing the Yield of the Kensington Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897 ...	Menzies Kensington, G.M.L. 3277z ...	466·00	408·97	·87
1898 ...	Do. " ...	327·00	217·68	·66
1899 ...	Do. " ...	135·00	133·06	·98
1900 ...	Do. " ...	..	23·32	...
1901 ...	Kensington, G.M.L. 3277z	33·00	83·99	2·54
1902 ...	Do. "	...	...	...
1903 ...	Do. "	102·00	21·20	·21
1904 ...	Do. "	10·00	5·19	·51
	Total	**145·00**	**110·38**	**·83**

The **True Blue**, G.M.L. 5130z, is situated a little to the eastward of the Kensington line and south of the Picton, and in it a small vein of rich quartz has been traced for a length of 400 feet at a depth of 40 feet from the surface.

Table showing the Yield from the True Blue Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons	ozs.	ozs.
1903 ...	True Blue, G.M.L. 5130z	22·00	42·02	1·21
1904 ...	Do. "	57·00	128·40	2·25
1905 ...	Do. "	18·00	16·35	·90
	Total	**97·00**	**186·77**	**1·92**

Farther east still upon the western side of Mt. Misery are two old leases which have covered the same ground called respectively the **Picton Valley**, G.M.L. 4890z, and the **Lady Min**, G.M.L. 4917z. The reef is small but well defined, striking north-east and dipping south-east, and can be traced into the Maranora, which appears to be the southern extension of it.

The workings consist of two groups of shallow underlay shafts in which apparently some 3 or 4 inches of the hanging-wall side has been worked to a depth of 20 feet.

Table showing the Yield of the Lady Min Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons	ozs.	ozs.
1898 ...	Picton Valley, G.M.L. 4890z	10·00	21·51	2·15
1899 ...	Do. „	10·00	14·31	1·43
1899 ...	Lady Min, G.M.L. 4917z	5·00	9·91	1·98
1900 ...	Do. „	10·00	46·37	4·63
	Total	**35·00**	**92·10**	**2·63**

The Old Hidden Treasure, G.M.L. 4750z, is now being worked as the Maranora, G.M.L. 4895z, and in it a reef dipping at an angle of 80 degrees south-east which, varying from a few inches to seven feet in thickness, has been opened up to a depth of 140 feet by a level 300 feet in length, the course of which is 21 degrees east of north. The shaft has been continued to a depth of 198 feet, a small supply of stock water being cut at 150 feet.

The reef is enclosed in a formation carrying a little gold, the thickness of which has not yet been tested.

The character of this reef cannot be determined at the only level accessible, but it presents many indications of being of the fissure type; this is further supported by its length of outcrop [**1053**].

Table showing the Yield of the Maranora Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs..	ozs.
1898 ...	Hidden Treasure, G.M.L. 4750z ...	10·00	5·20	·52
1899 ...	Maranora, G.M.L. 4895z	278·30	281·65	1·01
1900 ...	Do. „	307·00	402·30	1·31
1901 ...	Do. „	223·00	216·50	·97
1902 ...	Do. „	215·00	226·04	1·05
1903 ...	Do. „	272·00	292·63	1·07
1904 ...	Do. „	286·00	236·25	·83
1905 ...	Do. „	454·00	479·78	1·17
	Total	**2,035·50**	**2,135·15**	**1·04**

To the southward of the last are a group of old leases which have covered more or less the same ground; these consist of the Kensington Easter Gift, G.M.L. 5103z, Prince Albert, G.M.L. 4926z, West Sea, G.M.L. 4908z, and Moonlight, G.M.L. 5183z. On these a small reef, from five to six inches in width, dipping to the westward, has been opened up to a depth of 60 feet and worked for a length of five chains.

Table showing the Yield from sundry Leases.

Year.	Name and Number of Leases.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1903 ...	Kensington Easter Gift, G.M.L. 5103z	13·00	19·97	1·46
1904 ...	Do. ,,	4·00	3·45	·86
	Total	**17·00**	**23·42**	**1·38**
1899 ...	West Sea, G.M.L. 4908z	12·00	7·43	·62
1899 ...	Prince Albert, G.M.L. 4926z	6·00	4·91	·82
1900 ...	Do. ,, ...	15·00	6·43	·43
1904 ...	Moonlight, G.M.L. 5183z	35·00	25·71	·73
	Total	**68·00**	**44·48**	**·65**

To the eastward of the last, another line has been worked as the BRILLIANT, G.M.L. 5184z, the KENSINGTON SUNDAY GIFT, G.M.L. 4819z, or SUNDAY GIFT, G.M.L. 5010z, and the MENZIES LUXEMBERG, G.M.L. 5043z. The reef here strikes north and south and dips west, being two to six feet thick in the Brilliant; on the Sunday Gift it has been sunk on to a depth of 80 feet, and is about 12 inches in thickness, whilst in the Luxemberg the stone is small, but it has been worked for a length of 100 feet, to a depth of 40 feet, where the hard rock comes in. This vein at its north end is very flat, but generally dips steeper towards the south end.

Table showing the Yield of sundry Leases.

Year.	Name and Number of Leases.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899 ...	Brilliant, G.M.L. 4911z	13.00	8·45	·65
1904 ...	Brilliant, G.M.L. 5184z	12·00	3·41	·28
1905 ...	Do. ,, ...	14·00	2·20	·16
	Total	**39·00**	**14·06**	**·38**
1896 ...	Kensington Sunday Gift, G.M.L. 4819z	26·00	27·81	1·07
1901 ...	Sunday Gift, G.M.L. 5010z	16·00	50·64	3·16
1902 ...	Do. ,, ...	72·30	197·59	2·74
1903 ...	Do. ,, ...	57·00	140·55	2·46
1904 ...	Do. ,, ...	68·00	65·59	·96
1905 ...	Do. ,, ...	88·00	89·32	1·02
	Total	**353·00**	**599·31**	**1·79**
1902 ...	**Menzies Luxemberg, G.M.L. 5043z ...**	**6·00**	**5·02**	**·83**

THE VIKING, G.M.L. 5038z, is a line further east still, and upon it a vein of stone, which runs in pipes varying from six to 12 inches in thickness, has been worked for a length of 200 feet, the deepest shaft being 70 feet.

Table showing the Yield of the Viking Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1902 ...	Viking, G.M.L. 5038z	30·00	137·59	4·58
1903 ...	Do. „	21·00	81·36	3·87
1904 ...	Do. „	18·00	112·05	6·22
1905 ...	Do. „	21·00	83·99	3·99
	Total	**90·00**	**414·99**	**4·61**

About 2½ miles south of the Kensington Group are one or two leases situated at what is known as Springfield, from the first property taken up upon which a good supply of fresh water was obtained.

SPRINGFIELD, G.M.L. 4950z.—On this lease a flat lode dipping south has been worked for the the past five years by a number of shallow vertical shafts and surface working. It has not proved so far to continue of value in depth nor to extend east or west.

A vertical shaft has also been sunk to a depth of 130 feet in which a supply of 1,500 gallons per diem of fresh water was struck.

Table showing the Yield of the Springfield Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1900 ...	Springfield, G.M.L. 4950z	39·00	25·11	·64
1902 ...	Do. „	209·00	183·14	·87
1903 ...	Do. „	115·00	88·79	·77
1904 ...	Do. „	279·00	176·77	·63
1905 ...	Do. „	145·00	110·00	·76
	Total	**787·00**	**583·81**	**·74**

A little north of this some old shafts on the flat indicate what was the BLOW FLY, G.M.L. 4964z, but this was only worked a short time and was never surveyed. From this lease 50·00 tons of stone were crushed, which yielded 32·29 ounces of gold.

South of Springfield is a lease called the EMU, G.M.L. 5164z, upon which a small reef which dips west is being worked, but little has been done on it as yet.

This lease was originally called the MYRTLE, G.M.L. 5082z, but the workings then consisted of some shallow shafts on a quartz reef on the hill to the westward.

Table showing the Yield of the Emu Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1903 ...	Myrtle, G.M.L. 5082z	56·00	57·94	1·03
1903 ...	Emu, G.M.L. 5144z	35·00	118·70	3·39
1904 ...	Do. 5164z	118·00	277·29	2·35
1905 ...	Do. „	177·00	417·95	2·36
	Total	**386·00**	**871·88**	**2·26**

The **Kurrajong**, G.M.L. 3482z, **Fulcrum**, G.M.L. 5202z, and **Hopeful**, G.M.L. 5206z, lie about one and a half miles east of Mt. Misery. The first mentioned was only worked for a short time in the early days of the goldfield upon a small diorite outcrop, whilst the latter two were two small recent holdings upon patchy barren looking veins in the granite, near which some specks of gold had been discovered.

Table showing the Yield of sundry Leases.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896 ...	Kurrajong, G.M.L. 3482z	**5·00**	**9·29**	**1·86**
1898	Federal, G.M.L. 4885z	44·00	51·41	1·16
1905 ...	Fulcrum, G.M.L. 5202z	12·00	11·02	·92
	Total	**56·00**	**62·43**	**1·11**
1904 ...	Hopeful, G.M.L. 5206z	12·00	22 51	1·87
1904 ..	Do. „	6·00	5·37	·89
	Total	**18·00**	**27·88**	**1·54**

Sundry Claims.

Under this head an item appears annually in the returns, with the exception of 1903, as follow:—

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1897	18·00	9·02	·50
1898	118·75	140·87	1·19
1899	231·25	235·04	1·01
1900	179·00	155·42	·87
1901	63·00	65·20	1·03
1902	625·00	842·04	1·34
1904	358·00	385·56	1·08
1905	927·00	597·61	·64
Total ...	**1,910·00**	**1,721·46**	**·90**

Section III.—Conclusion.

In order to make the occurrence of the typical Menzies lode as clear as possible (the segregation, not the fissure veins, are here referred to) a brief *résumé* of their occurrence will be given.

It will have been noted from the foregoing description of the various mines in which segregation veins were worked that the formations downwards may be divided into three zones:—1st, the upper, which extends down to the water level, in which oxidation has taken place; this zone is of variable extent even in reefs situated in close proximity, and is not entirely governed by surface configuration. 2nd, the belt of water-bearing rock or zone of saturation, the limit of which in depth is governed by the permeable nature of the formation, and may, as in the case of the Shenton Reef, be entirely absent owing to local conditions, such as an impervious laterite covering which has prevented the down flow of meteoric waters, whilst a few chains west, in sinking the main shaft, a considerable supply of water was cut which has now risen through the connecting workings and flooded the workings which were previously dry; and 3rd, below the zone of saturation, when the country rock is massive and dry, being practically impervious to the overlaying water.

In the oxidised zone the rocks are usually soft near the surface, being highly weathered, consisting of yellow argillaceous and magnesian nature, passing imperceptibly into more or less weathered serpentine and chloritic schists. In this zone numerous lines of auriferous lodes are met with; they are of the composite order, consisting of a series of lenticular quartz veins or pipes which follow the rock foliation.

These veins may lie in a single line, one lens forming at or near the terminal point of the other, or, as is more commonly the case, overlapping one another, each following vein lying upon a parallel line of foliation. The lode body may be composed of a series of these parallel veins so arranged that the entire mass assumes a more or less lenticular form, *i.e.*, increasing in thickness towards the centre and diminishing towards the ends along the line of strike. Near the surface an enclosing zone of enriched decomposed rock is not infrequently met with which is termed "formation."

Below the water level the lode changes considerably in character, the ore body becoming a sulphide lode, and consists of definite shoots and blanks; the shoots appear as a general rule to cut out upon coming in contact with the solid country, or to penetrate it for only a short distance.

Below the terminal point of these shoots considerable prospecting has been done, but so far no vein encountered has proved of sufficient value to be worth working.

Owing to the fact that the surface of the auriferous belt is for the most part covered by superficial deposits, the reefs do not as a rule outcrop, but to judge from the mode of occurrence of those already discovered, it is probable that numerous others exist, and when it is noted that a very large area in the very heart of the belt has been scarcely prospected it is quite possible that even large and rich lodes may yet be discovered.

Since the erection of the State Battery the working miners have been enabled to profitably work many of the small but rich veins of stone which the companies had abandoned, and the return from this source alone is responsible for a very considerable proportion of the annual gold production of the district; in fact, without it, since the closing down of so many large mines, the district would have retrograded considerably.

Table showing the Return of the Ore treated at the Menzies State Battery.

Year.	Ore treated.	Gold therefrom.	Rate per ton.
	tons.	oz.	oz.
1904	5,067	7,508	1·48
1905	4,138	5,502	1·33
Total	**9,202**	**13,010**	**1·41**

The opening up of small veins in old workings has led to further prospecting, which has in many instances been amply rewarded by the discovery of other lines. This leads to the conclusion that in the main Menzies belt beneath the alluvium a large series of parallel lines of veins very probably exist, and should this prove to be the case, although the larger lodes may be worked out, this district may reasonably look forward to a very considerable and prosperous future.

Appendix I.

Synoptical Table showing the Yield of the Leases at Menzies up to the end of 1905.

Notes.—(1.) Leases having the same name but are situated in different localities.
(2.) Leases with the same name covering a portion of the same ground.

Name of Lease or Company.	Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Ada Ella	5185z	10·00	5·53	·55
Adelaide (1)	3378z	13·50	17·14	1·27
Do. (1)	5128z	109·50	52·02	·47
Africander (2)	3034z	189·00	250·42	1·32
Do. (2)	4984z	47·00	56·34	1·19
Do. (2)	5253z	34·50	38·09	1·10
Alexandra	4918z	103·00	171·89	1·67
Ancient Briton Extended	4007z	26·00	20·79	·78
Anti-Daglish	5225z	10·00	17·76	1·77
Athelstane	4873z	458·00	204·50	·45
Baden Powell (2)	5089z	17·00	18·20	1·07
Do. (2)	5241z	146·00	212·63	1·45
Ballarat Menzies	5113z	64·75	18·06	·28
Barunga Brave	4691z	23·00	19·72	·86
Battler's Rest	5143z	21·00	18·03	·86
Bellinger	5114z	31·00	9·02	·29
Blaas Reward	5026z	23·00	17·64	·77
Black Horse	5106z	216·00	250·31	1·16
Black Jack	4879z	961·00	1,096·53	1·14
Black and White	4978z	82·00	35·56	·43
Blow Fly	4954z	50·00	32·29	·65
Brilliant (2)	4911z	13·00	8·45	·65
Do. (2)	5184z	26·00	5·61	·21
Bristol	5116z	26·00	7·70	·30
Britannia	4850z	8·00	2·74	·34
Broken Seal	5022z	35·00	25·66	·73
Brown Hill	4949z	31·00	14·91	·48
Busy Bee	5105z	207·00	80·77	·39
Butterfly	4992z	97·50	167·20	1·71
Central Menzies	2834z	19·00	18·15	·95
Christmas Gift	5016z	93·00	83·86	·90
Columbia	5104z	18·00	9·86	·55
Coronation	5041z	10·00	8·39	·84
Coronation Gift	5064z	29·00	22·25	·77
Cosmopolitan	4961z	52·00	23·71	·45
Craig-y-Nos (2)	4940z	527·25	349·91	·66
Do. (2)	5220z	220·00	88·15	·40
Crown Cross (2)	4860z	234·00	181·66	·77

APPENDIX I.—*Synoptical Table showing the Yield of the Leases at Menzies up to the end of 1905*—continued.

Name of Lease or Company.	Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Crown Cross (2)	4912z	594·50	1,485·03	2·49
Do. (2)	4967z			
Do. South Extended	4979z	101·00	498·01	4·53
Crusoe Gold Claims, Ltd.	2823z, 3009z, 5017z, & 5018z	30,254·00	29,895·11	0·99
Daisy Bell	4061z	72·00	69·34	·96
Danae...	5050z	10·00	3·89	·39
Double Event	5135z	74·00	61·20	·83
Dublin Castle (2)	4952z	274·00	503·18	1·83
Do. (2)	5215z	141·00	230·38	1·63
Easter Gift	5095z	23·00	5·66	·24
Emu (2)	5144z	35·00	118·70	3·39
Do. (2)	5164z	295·00	695·24	2·35
Etrenna and Aurelia ...	4965z & 4966z	224·25	221·24	·98
European	5210z	8·00	5·25	·65
Federal	4885z	44·00	51·41	1·17
Federation	4959z	30·00	13·19	·43
Florence	2821z	6,664·00	6,354·88	·95
Flying Fish Leases	4982z & 4991z	209·50	730·66	3·48
Flying Fish	5089z	699·00	1,261·32	1·80
Four o'clock (2)	5012z	55·00	31·31	·57
Do. (2)	5072z	73·00	69·94	·96
Freeman	5039z	30·00	20·75	·69
Fulcrum	5202z	12·00	11·02	·92
Gem Extended (2)	4849z	123·50	55·17	·45
Do. (2)	4957z	15·00	6·33	·42
Do. (2)	5015z	15·00	6·92	·46
Gift	4916z	10·00	5·37	·54
Golden Age (2)	5005z	76·00	41·09	·54
Do. (2)	5092z	47·00	54·85	1·17
Golden Butterfly	4997z	120·00	36·37	·30
Golden Crown	4973z	16·00	35·42	8·21
Golden Horseshoe	4990z	20·00	7·31	·36
Golden Shoe	4861z	44·00	51·36	1·17
Golden Star	4907z	19·00	14·13	·74
Goodenough	4855z	4447·95	6220·66	1·39
Great Hope	5090z	12·50	21·85	1·74
Great Klondyke	4853z	16·80	36·94	2·20
Guiding Star	4951z	271·35	268·26	·99
Hayles and Taverstock ...	5000z	84·00	107·15	1·27
Heart's Content	4947z	44·00	82·37	1·87
Home Signal	4993z	5·00	4·94	·98

APPENDIX I.—*Synoptical Table showing the Yield of the Leases at Menzies up to the end of 1905*—continued.

Name of Lease or Company.	Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Homeward Bound	5173z	33·00	4·82	·14
Hornet's Nest	4998z	5·00	1·68	·33
Hopeful	5206z	18·00	27·88	1·54
Horseshoe	5045z	43·00	13·74	·31
Indus	4291z	16·00	2·76	·17
Industria	4899z	44·00	14·94	·34
Ivy	4942z	15·00	1·58	·10
Jimgellie	4878z	42·00	28·78	·68
Just-in-time (2)	4886z	24·00	12·04	·50
Do. (2)	5141z	25·00	4·08	·62
Kensington	3277z	145·00	110·38	·84
Kensington Easter Gift	5103z	17·00	23·42	1·38
Kensington Sunday Gift	4819z	26·00	27·81	1·07
Kensington Vindicator	3615z	33·00	47·70	1·44
Klondyke (2)	5131z	16·80	36·94	2·20
Do. (2)	5156z	16·00	6·33	·39
Do. (2)	5226z	52·00	11·72	·22
Kurrajong	3482z	5·00	9·29	1·86
Lady Fanny	5179z	16·00	10·09	·63
Lady Harriet	2822z	759·00	645·45	·88
Lady Harriet Leases	4972z & 5002	2,177·00	2,023·38	·95
Lady Main	3963z	95·00	112·65	1·19
Lady Min	4917z	15·00	56·28	3·75
Lady Sarah	5009z	138·00	127·97	·92
Lady Shenton	2820z & 3006z	96,280·00	132,101·31	1·37
Lady Sherry	2838z	904·25	744·65	·82
Lincoln (1)	5134z	31·00	71·75	2·31
Do. (1)	5181z	61·00	106·42	1·74
Lion (2)	5069z	48·00	115·91	2·41
Do. (2)	5244z	43·00	56·70	1·32
Little Peter	5201z	10·00	3·41	·34
Little Tom	5083z	25·00	40·49	1·62
Little Vic	5225z	7·50	11·97	1·59
Little Wonder (2)	5139z	14·00	15·96	1·14
Do. (2)	5163z	94·00	329·98	3·51
Do. (2)	5189z	276·00	581·09	2·10
London and Coolgardie Explorers, Ltd. (2)	3116z & 3118z	340·00	394·23	1·12
London and Coolgardie Explorers, Ltd. (2)	5013z	43·00	60·75	1·39
Lone Hand	5230z	59·00	50·40	·85
Lord Nelson	5021z	12·00	4·55	·37
Lord Roberts (2)	5007z	69·00	38·09	·55
Do. (2)	5168z	26·00	7·06	·27

Appendix I.—*Synoptical Table showing the Yield of the Leases at Menzies up to the end of 1905*—continued.

Name of Lease or Company.	Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Lucky Hit	5137z	40·00	15·24	·38
Lucky Prop	5127z	72·00	17·96	·24
Lucky Strike	5194z	36·00	5·10	·14
Lucky Venture	5151z	45·00	9·49	·21
Maori (2)	4983z	64·00	80·72	1·26
Do. (2)	5196z	12·00	2·63	·22
Maori Gold Mine, Ltd.	3059z	571·00	654·06	1·11
Maori Chief (2)	4914z	303·00	218·41	·32
Do. (2)	4987z	543·00	474·68	·87
Maranora	4895z	2,035·30	2,135·15	1·04
McClay's Welcome	3744z	82·00	48·77	·59
Menzies, Limited	2826z, 2828z, 2829z, 3050z, 3051z, 3055z, and 3056z	308·00	457·23	1·49
Menzies Alpha Leases, Ltd.	3011z and 3031z	11,037·00	15,537·74	1·40
Menzies Consolidated Gold Mines, Ltd.	4931z, 4934z/6z	99,371·00	65,875·05	·66
Menzies Fortuna	5136z	137·00	139·74	1·09
Menzies Gift	3036z	50·00	12·74	·26
Menzies Gold Estates, Ltd.	3042z, 3046z, and 3054z	431·00	149·90	·35
Menzies Gold Reefs Proprietary	2824z/5z and 2842z	6,063·00	11,293·59	1·86
Menzies Golden Age	2830z	292·50	1,059·00	3·62
Menzies Horseshoe	5145z	62·00	19·02	·30
Menzies Kensington	3277z	928·00	783·03	·84
Menzies Kensington East	4750z	10·00	5·20	·52
Menzies Lady Mary	3121z	14·00	1·22	·08
Menzies Lady Sherry	2835z	2,208·00	2,341·48	1·06
Menzies Luxemberg	5043z	6·00	5·02	·83
Menzies Main Reef (1)	4897z	39·00	15·98	·42
Do. (1)	5149z	37·00	10·00	·27
Menzies Mining and Exploration Corporation, Ltd.	3100z, 2832z, 2843z/4z, etc.	14,243·45	20,551·65	1·44
Menzies Pioneers	2822z	613·00	717·83	1·17
Menzies Proprietary (2)	4953z	129·25	162·69	1·25
Do. (2)	5140z	201·00	145·72	·72
Do. (2)	5236z	128·00	270·15	2·11
Menzies Star	5118z	114·00	62·09	·54
Menzies United	3345z	139·00	96·09	·69
Menzies United, Ltd.	3151z	121·85	115·14	·94
Meriyulah	4960z	305·00	343·95	1·12
Moonlight	5183z	35·00	25·71	·73
Myrtle	5082z	56·00	57·94	1·03
Never Despair	5225z	81·00	42·10	·50
Nil Desperandum	4941z	87·00	195·77	2·25
Nugget	5209z	87·00	144·92	1·66

APPENDIX I.—*Synoptical Table showing the Yield of the Leases at Menzies up to the end of 1905*—continued.

Name of Lease or Company.	Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Oceanic (2)	4920z	101·00	62·13	·61
Do. (2)	4969z	50·00	26·52	·53
Olive Branch	5112z	40·00	8·29	·20
Opal	5100z	30·00	4·71	·15
Ophir	5186z	17·00	5·92	·35
Ourine	4977z	30·00	22·83	·76
Perseverance	5102z	98·00	29·52	·30
Picton	4985z	370·50	99·07	·27
Picton Valley	4890z	20·00	35·82	1·79
Prince Albert	4926z	21·00	11·34	·54
Queenslander	5126z	36·00	20·35	·56
Queensland Menzies G.M. Co.	...	44,851·00	73,808·82	1·64
Rescue	5065z	48·00	79·06	1·68
Resurgam (2)	5076z	21·00	29·69	1·41
Do. (2)	5117z	15·00	9·42	·62
Resurrection	4859z	46·50	23·22	·50
Rising Sun	5040z	10·00	10·03	1·00
Sailor	5109z	...	·59	...
Secret	5232z	56·00	150·52	2·68
Sefton	5080z	8·10	12·66	1·56
Sentinal	5204z	55·00	35·58	·64
Sophia	5233z	113·00	79·34	·70
Springfield	4950z	787·00	583·81	·74
St. Albans (2)	4883z	403·75	687·09	1·70
Do. (2)	5081z	73·00	109·04	1·49
Success	4980z	120·00	114·09	·95
Sunday Gift	5010z	353·00	599·31	1·79
Surprise	5002z	123·00	116·24	·94
Three Battlers	4871z	57·00	40·09	·72
True Blue (1)	3322	100·00	24·05	·24
Do. (1)	5130	97·00	186·77	1·92
True Blue South	4923	51·00	54·41	1·06
Two Walters	5207z	80·00	30·78	·38
Union Jack	4889z	593·00	679·10	1·16
Victoria Cross	5131z	32·00	7·48	·23
Victory	5066z	239·00	533·63	2·23
Victory North	5068z	172·50	274·63	1·59

APPENDIX I.—*Synoptical Table showing the Yield of the Leases at Menzies up to the end of 1905*—continued

Name of Lease or Company.	Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Victory South	5094z	287·00	311·81	1·08
Viking	5038z	90·00	414·99	4·61
Vindicator South	4924z	29·00	32·83	1·12
Wallaroo Menzies G.M. Co.	3235z & 3398z	12·00	2·42	·20
Warrior Menzies G.M. Co.	3048z	1,153·00	729·06	·63
Warrior	3048z	650·00	418·49	·64
Welcome	5101z	90·00	24·53	·27
West Sea	4908z	12·00	7·43	·62
W.A. Development Syndicate	3206z	177·50	113·17	·63
Westralia Menzies	5034z	20·00	32·56	1·14
Witch Hazel	5154z	21·00	8·82	·42
Sundry Claims	...	1,910·00	1,721·46	·90

Appendix II.

List of Specimens in the Geological Survey Museum from the Menzies District.

Registered Number of Specimen.	Registered Number of Micro-slide.	Name of Specimen.	Locality of Specimen.	Remarks.
750	...	Serpentine schist	Alpha, G.M.L. 3011z	
751	24	Mica schist	Warrior, G.M.L. 3048z	
752	...	Serpentine schist	Golden Age, G.M.L. 2830z	
753	...	Ironstone	G.M.L. 3478z	
754	23	Hornblend schist	Alpha, G.M.L. 3011z	
755	...	Mica schist	Warrior, G.M.L. 3048z	
756	...	Lode stuff	Shenton North, G.M.L. 2826z	
757	...	Mica schist	Occidental, G.M.L. 3340z	
758	...	Weathered diorite	do. do.	
785	...	Quartzite	Marie, G.M.L. 4576z	
786	...	Ferruginous quartzite	do. do.	
787	...	Weathered granite	Water right, 234	
788	...	Weathered hornblend schist	do. 189	
789	...	Decomposed schist	Lady Sherry, G.M.L. 2835z	
790	...	Gneissic granite	Lady Mary, G.M.L. 3121z	
791	...	Bedded kaolin	Water right, 262	
792	...	Siderite, on gneissic granite	Lady Mary, G.M.L. 3121z	
793	...	Hornblend rock (gneissic)	do. do.	
794	...	Hornblend rock	Hill upon east side of town	
795	...	Schistose diorite	do. do.	
796	...	Ironstone	Mt. Owen	
802	...	Ferruginous quartzite	Liberator East, G.M.L. 4084z	
803	...	Gneiss	Shenton Extended, G.M.L. 3124z	
804	...	Diorite schist	Liberator, G.M.L. 3821z	
805	...	Gneissic diorite	St. Albans, G.M.L. 3104z	
806	...	Gneiss	Te Pakeha, G.M.L. 4420z	
807	...	Amphibolite	Liberator, G.M.L. 3821z	
808	...	Gneiss	Jackeroo, G.M.L. 3075z	

809	...	Schist	Hardup South, G.M.L. 4234z
810	...	Diorite	Delta, G.M.L. 4336z
811	...	Mica schist	Union Jack, G.M.L. 3002z
812	...	Hornblend schist	Zeta, G.M.L. 4225z
813	...	Mica schist	Daisy Bell, G.M.L. 4061z
814	...	Weathered schist	Robbie, G.M.L. 4047z
1036	...	Sample of lode at surface	Lady Shenton, G.M.L. 2820z
1037	...	Do. do.	do. do.
1038	...	Lode stuff, showing paint gold, 60ft. level	do. do.
1039		Diorite, carrying galena and gold, 230ft. level	do. do.
1040	...	Sulphide stone, 210ft. level	do. do.
1041	...	Mineralised stone, assaying 14·70ozs., 250ft. level	do. do.
1042	...	Casing of reef	do. do.
1043	...	Wall of reef	do. do.
1044	...	Auriferous diorite (crushing stone)	do. do.
1045	...	Auriferous quartz, 160ft. level	Florence, G.M.L. 2821z
1046	369	Schistose felstone	Jowett's Well
1047	...	Serpentine schist	Princess May, G.M.L. 3113z
1048	...	Gneissic felstone	Darwin, G.M.L. 3024z
1049	...	Do.	do. do.
1050	...	Do.	do. do.
1051	...	Gneissic felstone (auriferous)	Darwin, G.M.L. 3024z
1052	...	Quartz vein in serpentine	Princess May, G.M.L. 3118z
1053	...	Fibrous serpentine	Hidden Treasure, G.M.L. 4750z
1054	...	Semi-fibrous serpentine	do. do.
1169	380	Sericite schist	Hill N.W. of Emu, G.M.L. 5164z
1170	...	Do.	Hill south of Springfield, G.M.L. 4950z
1171	...	Weathered schist	Hill N.W. of Emu, G.M.L. 5164z
1172	...	Gneiss	Half-mile east of Emu, G.M.L. 5164z
1173	1	Felsite dyke	South of the Water Reserve fence
1174	379	Banded quartzite	Hill half-mile N.E. of Merry's Well
1175	...	Silicified diorite	do. do.
1176	...	Weathered sericite schist	do. do.
1177	...	Iron ore (limonite)	Road half-way between Woolgar and Merry's Well

APPENDIX II.—*List of Specimens in the Geological Survey Museum from the Menzies District*—continued.

Registered Number of Specimen.	Registered Number of Micro-slide.	Name of Specimen.	Locality of Specimen.	Remarks.
1178	...	Pisolitic iron ore with secondary silica ...	Half-mile west of Merry's Well	
1179	380	Quartz schist	Hill N.W. of the Emu, G.M.L. 5164z	
1180	26	Hornblend schist	Hill north of Merry's Well	
1182	...	Quartz	Half-mile east of Emu, G.M.L. 5164z	
1184	...	Sericite schist	Hill N.W. of Emu, G.M.L. 5164z	
1185	...	Weathered felsite	Barunga Brave, G.M.L. 4691z	
1186	...	Granitic gneiss	Explosive Reserve	
1187	...	Weathered schist	Half-mile east of the Emu, G.M.L. 5164z	
1188	...	Sericite schist	Quarter-mile S.W. of Emu, G.M.L. 5164z	
1189	...	Quartzite	Barunga Brave, G.M L. 4691z	
1190	...	Sericite schist	Ulster, G.M.L. 4757z	
1191	...	Quartz porphyry	South of the Water Reserve	
1192	...	Hornblend diorite	S.E. corner of Water Reserve fence	
1193	...	Weathered schist	Ridge half-mile N.E. of Merry's Well	
1194	...	Felsite dyke	Ridge three-quarters-mile N.W. of Merry's Well	
1195	...	Mica schist	Ridge half-mile N.E. of Merry's Well	
1196	...	Serpentine schist	Hill east of Emu, G.M.L. 5164z	
1197	...	Pyriteous lode stuff	Czar, G.M.L. 4678z	
1198	...	Amphibolite	do.	
1199	...	Mica felsite	N.W. of Merry's Well	
1200	...	Decomposed granite	Road between Woolgar and Merry's Well	
1201	...	Serpentine schist	Half-mile east of Emu, G.M.L. 5164z	
1202	...	Quartzite	Hill half-mile N.E. of Merry's Well	
1203	...	Ironstone	Half-mile east of Emu, G.M.L. 5164z	
1204	...	Do.	Half-mile S.W. of Emu, G.M.L. 5164z	
1205	...	Diorite	Half-mile N.E. of Woolgar	
1206	...	Do.	Ridge half-mile N.E. of Merry's Well	
1207	...	Pyrites lode stuff	Czar, G.M.L. 4678z	
1208	...	Do.	do.	
1209	...	Quartz in decomposed rock	Menzies Mt. Morgans, G.M L. 4552z	

1210	...	Mica schist	do. do.
1211	...	Do.	Half-mile south of S.W. corner of Water Reserve
1317	...	Mica felsite	Water Right 226
1318	...	Hornblende schist	do.
1319	...	Muscovite granite	Durable, G.M.L. 3112z
6311	...	Quartz and Pyrites (mineral lode)	Queensland Menzies, G.M.L. 3836z
6312	...	Auriferous diorite	do. do.
6313	...	Glaucophane	Flat north of Merry's Well
6314	...	Auriferous quartz and pyrrhotite	Menzies Consolidated, G.M.L. 4935z
6315	...	Limestone	Near Emu, G.M.L. 5164z
6316	...	Do.	Corner of G.M.Ls. 4781z and 4359z
6317	...	Limonite	S.E. corner of Water Reserve
6318	...	Granite	G.M.L. 3112z
6319	...	Orthoclase	do.
6320	...	Quartzite	Springfield Road, S.E. of G.M.L. 4359z
6321	...	Sericite schist	do. do.
6322	...	Dolomite	Crusoe, G.M.L. 2823z
6323	...	Asbestos	do. do.
6324	...	Schist from fault wall	Queensland Menzies, G.M.L. 3836z
6325	...	Serpentine schist	Crusoe, G.M.L. 2823z
6326	...	Hornblend schist (weathered)	do. do.
6327	...	Do. do. (micaceous)	Shaft half-mile west of Goodenough, G.M.L. 4855z
6328	...	Mica schist	do.
6329	...	Amphibolite	Shaft north of Goodenough, G.M.L. 4855z
6330	..	Do.	Menzies Alpha Leases, G.M.L. 3031z
6331	...	Aphanitic diorite	Menzies Gold Estate, G.M.L. 3054z
6332	...	Mica schist	Golden Age, G.M.L. 2830z
6333	...	Do.	do. do.
6334	...	Crushed porphyritic granite	do. do.
6335	...	Quartz porphyry	McClay's Welcome, G.M.L. 3744z
6336	...	Porphyritic granite	Lady Shenton, G.M.L. 5006z
6337	...	Weathered porphyritic dyke	Goodenough, G.M.L. 4855z
6338	...	Do. do. do.	Golden Shoe, G.M.L. 4861z
6339	...	Granite	Water Right 193

APPENDIX II.—*List of Specimens in the Geological Survey Museum from the Menzies District*—continued.

Registered Number of Specimen.	Registered Number of Micro-slide.	Name of Specimen.	Locality of Specimen.	Remarks.
6340	...	Sericite schist	Goodenough, G.M.L. 4855z	
6341	...	Weathered porphyritic dyke	Ray's Water Shaft	
6342	...	Mica schist	Florence, G.M.L. 2821z	
6343	...	Weathered porphyry	Princess, G.M.L. 2829z	
6344	...	Gneissic rock	N.W. corner of G.M.L. 4861z	
6364	...	Mica schist	Goodenough, G.M.L. 4855z	
6365	...	Sericite schist	G M.L. 4789z and ridge to southward	
6366	...	Crushed granite	Federal, G.M.L. 4885z	
6367	...	Felsite	Quarries in Water Reserve	
6368	619	Do.	do. do.	
6369	620	Do.	do. do.	
6370	...	Do.	do. do.	
6371	...	Porphyritic dyke	Warrior, G.M.L. 3048z	

NOTE.—Specimens numbered from 750 to 1319 were collected by Mr. Campbell when acting as Topographical Surveyor.

INDEX TO NAMES OF PLACES, MINES, REEFS, Etc.

Page
Acidic Rocks ... 6, 12, 14
Ada Ella Lease ... 23, 76
Adelaide Lease ... 49, 51, 58, 59, 76
Africander Lease ... 52, 76
Alexandra Lease ... 67, 68, 76
Alexandria Lease ... 52
Alluvium ... 12, 13
Alpha Lease ... 43, 44, 46, 47, 82
Alpha South Lease ... 47
Altered Rocks ... 12
Ancient Britain Extended Lease ... 57, 76
Anti-Daglish Lease ... 65, 76
Armstrong's Shaft ... 46, 47
Aspasia Lease ... 25
Aspasia Lode ... 18, 19
Athelstane Lease ... 61, 76
Aurelia Lease ... 27, 28
Aurelia West Lease ... 28, 77

Baden Powell Léase ... 51, 76
Balkis Lease ... 36, 37
Ballarat Menzies Lease ... 59, 60, 76
Bantry Lease ... 38, 40
Barunga Brave Lease ... 20, 61, 76, 84
Basic Rocks ... 5, 12, 14
Battler's Rest Lease ... 55, 76
Bellinger Lease ... 57, 76
Blaas Reward Lease ... 66, 76
Black and White Lease ... 59, 60, 76
Black Horse Lease ... 61, 62, 76
Black Jack Lease ... 62, 76
Blow Fly Lease ... 72, 76
Brilliant Lease ... 71, 76
Bristol Lease ... 58, 59, 76
Britannia Lease ... 59, 60, 76
Broken Seal Lease ... 51
Brown, H. Y. L. ... 21, 24, 30, 32, 35, 42
Brown, J. ... 10
Brown's Hill Lease ... 66, 76
Busy Bee Lease ... 58, 59, 76
Butterfly Lease ... 68, 76

Campbell, W. D. ... 5, 11
Castle Blarney Lease ... 48, 49
Central Menzies Gold Mines, Ltd. ... 38, 76
Christmas Gift Lease ... 66, 76
Columbia Lease ... 59, 60, 76
Coronation Gift Lease ... 57, 76
Coronation Lease ... 65, 76
Cosmopolitan Lease ... 51, 76
Craig-y-nos Lease ... 61, 76
Crown Cross Lease ... 53, 76, 77

Page
Crown Cross South Extended Lease ... 53, 76, 77
Crusoe Gold Claims, Ltd. ... 30, 32, 77
Crusoe Hill ... 14
Crusoe Reefs ... 32, 85
Crusoe West Lease ... 27
Crystalline Rocks ... 5, 12, 14
Czar Lease ... 84

Daisy Bell Lease ... 57, 77, 83
Danae Lease ... 66, 77
Darwin Lease ... 83
Delta Lease ... 83
Descriptive Geology ... 12
Double Event Lease ... 57, 58, 77
Dublin Castle Lease ... 22, 23, 77
Durable Lease ... 84

Easter Gift Lease ... 23, 77
Economic Geology ... 19
Emulator Lease ... 38
Emu Lease ... 72, 73, 77, 83, 84, 85
Etrenna Lease ... 27, 28, 77
Eureka Lease ... 57
European Lease ... 22, 77

Falconer, Robert ... 45, 55
Federal Group ... 15
Federal Lease ... 73, 77, 86
Federation Lease ... 49, 77
Fennine Lease ... 38, 41
Florence Extended ... 40, 41
Florence Gold Mines, Ltd. ... 40
Florence Lease ... 40, 41, 43, 45, 46, 77, 83, 86
Florence North Lease ... 38
Flying Fish Reefs ... 38, 77
Four O'Clock Lease ... 65, 66, 77
Freeman Lease ... 29, 77
Friday Lease ... 30, 35, 36, 37
Fulcrum Lease ... 73, 77

Gem Extended Lease ... 59, 60, 77
Gem Lease ... 54, 58, 59
Gift Lease ... 61, 77
Golden Age Lease ... 49, 50, 77, 82, 85
Golden Butterfly ... 52, 77
Golden Crown Lease ... 50, 77
Golden Horseshoe Lease ... 59, 60, 77
Golden Shoe Lease ... 65, 77, 85
Golden Star Lease ... 51, 77
Gold Reefs Proprietary, Ltd. ... 50
Gold Yield ... 10
Goodenough ... 15, 17, 21, 64, 65, 77, 85, 86
Great Hope Lease ... 57, 77
Great Klondyke Lease ... 59, 60, 77
Greenstones ... 6
Guiding Star Lease ... 59, 60, 77

Page
Hardup South Lease ... 83
Hayles & Taverstock's United Lease ... 50, 77
Heart's Content Lease ... 48, 77
Helena Lease ... 24
Hidden Treasure Lease ... 83
Home Signal Lease ... 57, 77
Homeward Bound Lease ... 52, 78
Hopeful Lease ... 73, 78
Hornet's Nest Lease ... 59, 60, 78
Horseshoe Lease ... 29, 78
Hospital Reserve ... 16

Igneous Rocks ... 12
Indus Lease ... 55, 78
Industrial Lease ... 66, 78
Ishtar Lease ... 27, 28
Ivy Lease ... 53, 78

Jack, Dr. ... 32
Jackeroo Lease ... 82
Jackman, C. ... 10
Jimgellie Lease ... 57, 78
Jowett's Well ... 15, 16, 83
Just-in-Time Lease ... 59, 60, 78

Kensington Belt ... 15, 16, 21
Kensington Easter Gift Lease ... 70, 71, 78
Kensington Lease ... 17, 21, 69, 78
Kensington Sunday Gift Lease ... 71, 78
Kensington Vindicator Lease ... 67, 68, 78
Kirby, C. ... 10
Klondyke Lease ... 59, 60, 78
Kurrajong Lease ... 15, 73, 78

Lady Fanny Lease ... 58, 59, 78
Lady Harriet Leases ... 10, 55, 56, 58, 78
Lady Main Lease ... 62, 78
Lady Mary Lease ... 82
Lady Min Lease ... 69, 70, 78
Lady Sarah Lease ... 58, 59, 78
Lady Shenton East Lease ... 48
Lady Shenton Extended Lease ... 48
Lady Shenton Gold Mine, Ltd. ... 41, 55
Lady Shenton Lease ... 10, 13, 46, 78, 83 85
Lady Shenton North ... 38, 39, 41
Lady Shenton No. 1 Lease ... 49, 50
Lady Shenton South Extended Lease ... 49
Lady Sherry Lease ... 25, 78, 82
Lady Sherry West Lease ... 24
Last Chance Lease ... 52, 53
Laterites ... 12, 13, 14
Leonidas Lease ... 38, 39, 41
Liberator East Lease ... 82
Liberator Lease ... 82
Lincoln Lease ... 58, 59, 78
Lion Reef ... 39, 78

Page
Little Gem Lease ... 22
Little Peter Lease ... 22, 78
Little Tom Lease ... 68, 78
Little Vic Lease ... 65, 78
Little Wonder Lease ... 47, 49, 50, 78
Little Wonder North Lease ... 50
London and Coolgardie Explorers, Ltd. ... 52, 78
London and Coolgardie Reefs ... 53
Lone Hand Lease ... 62, 78
Lord Nelson Lease ... 59, 60, 78
Lord Roberts Lease ... 67, 78
Lucky Hit Lease ... 59, 60, 79
Lucky Prop Lease ... 55, 79
Lucky Strike Lease ... 59, 60, 79
Lucky Venture Lease ... 59, 60, 79
Luxemberg Lease ... 71

McClay's Welcome G.M. Co., N.L. ... 51, 79, 85
McDonald, J. ... 9, 41
McIntyre, J. ... 9
Maori Chief Lease ... 57, 58, 79
Maori Gold Mines, Ltd. ... 28, 79
Maori Lease ... 28, 29, 79
Maranora Lease ... 17, 69, 70, 79
Marcasite ... 6
Marie Lease ... 82
Menzies Alpha Leases, Ltd. ... 46, 47, 79, 85
Menzies Consolidated G.M., Ltd. ... 18, 19, 21, 62, 64, 79, 85
Menzies Crusoe Gold Claims, Ltd. ... 32
Menzies Fortuna Lease ... 52, 79
Menzies Gift Lease ... 61, 79
Menzies Golden Age Lease ... 49, 79
Menzies Gold Estates, Ltd. ... 27, 28, 31, 79, 85
Menzies Gold Reefs Proprietary, Ltd. ... 22, 35, 49, 79
Menzies Horseshoe Lease ... 29, 79
Menzies Kensington East ... 79
Menzies Kensington Lease ... 68, 69, 79
Menzies Lady Mary Lease ... 58, 79
Menzies Lady Sherry Lease ... 24, 79
Menzies, Ltd. ... 38, 79
Menzies L.R. ... 9, 41
Menzies Luxemberg Lease ... 71, 79
Menzies Main Reef ... 23, 50, 79
Menzies Mining and Exploration Corporation, Ltd. ... 24, 25, 27, 28, 37, 39, 47, 48, 79
Menzies Mt. Morgans Lease ... 84
Menzies Pioneers, Ltd. ... 55, 56, 79
Menzies Proprietary Lease ... 22, 79
Menzies Star Lease ... 59, 60, 79
Menzies United Lease ... 29, 36, 79
Menzies United Mines, Ltd. ... 37
Meriyulah Lease ... 48, 79
Merry's Well ... 17, 83, 84, 85
Mersey Lease ... 52
Monte Christo Battery ... 54
Monte Christo Lease ... 58, 59
Moonlight Lease ... 70, 71, 79
Mt. Misery ... 11, 15, 16, 21, 69
Mt. Owen ... 82
Myrtle Lease ... 72, 73, 79

Page

Naida Lease ... 30, 35, 36
Never Despair Lease ... 50, 60, 79
Niagara Road ... 15
Nick-of-Time Lease ... 61
Nil Desperandum Lease ... 53, 79
Nugget Lease ... 51, 79

Occidental Lease ... 82
Oceanic Lease ... 32, 35, 80
Old Hidden Treasure Lease ... 70
Olive Branch Lease ... 58, 59, 80
Olivia Lease ... 56
Opal Lease ... 55, 80
Ophir Lease ... 23, 80
Ore Deposits ... 21
Ourine Lease ... 57, 80

Pandora Lease ... 25
Pericles Lease ... 38, 39, 40, 41
Perseverance Lease ... 61, 80
Picton Lease ... 67, 80
Picton Valley Lease ... 69, 70, 80
Pioneer Lease ... 10
Prince Albert Lease ... 70, 71, 80
Princess Eva Lease ... 62, 63
Princess Lease ... 86
Princess May Lease ... 62, 64, 83
Princess May South Lease ... 62, 63, 64
Pyrrhotite ... 63

Quartz Reefs ... 17
Queenslander Lease ... 58, 59, 80
Queensland Menzies G.M. Co., N.L. ... 32, 35, 64, 80
Queensland Menzies Reef ... 35, 85

Rainfall ... 12
Ray's Shaft ... 42
Recent Superficial Deposits ... 12, 13
Rescue Lease ... 39, 80
Resurgam Lease ... 65, 66, 80
Resurrection Reef ... 22, 80
Rising Sun Lease ... 66, 80
Robbie Lease ... 83
Robinson Crusoe East Lease ... 30
Robinson Crusoe Lease ... 30

Sailor Lease ... 58, 59, 80
St. Alban's Group ... 20, 21, 80, 82
Secret Lease ... 80
Sefton Lease ... 57, 58, 80
Segregation Reefs ... 6
Selkirk Lease ... 22
Sentinel Lease ... 39, 80
Shenton Extended ... 82
Shenton North Lease ... 82

Page
Shenton Reef ... 46, 74
Shenton South-East Lease ... 48, 49, 50
Sherez Lease ... 52
Shirkin Lease... 38
Sophia Lease ... 59, 60, 80
Springfield Lease ... 5, 6, 72, 80, 83
State Battery ... 10, 75
Stirling Lease ... 46, 47
Storm King Lease ... 61
Stuart Lease ... 38
Success Lease ... 39, 80
Sunday Gift Lease ... 71, 80
Sundry Claims ... 73, 81
Superficial Deposits ... 5
Surprise Lease ... 24, 80

Taipo Lease ... 51
Taipo South Lease ... 51
Te Pakeha Lease ... 82
Three Battlers Lease ... 57, 80
True Blue Lease ... 67, 69, 80
True Blue South Lease ... 67, 80
Two Walters Lease ... 58, 80

Ulster Lease ... 84
Union Jack Lease ... 29, 80, 83

Victoria Cross Lease ... 53, 80
Victory Lease ... 24, 80
Victory North Lease ... 23, 80
Victory South Lease ... 26, 27, 80
Viking Lease ... 71, 72, 80
Vindicator South Lease ... 68, 80

Wallaroo Menzies G.M. Co., N.L. ... 54, 58, 81
Warrior Lease ... 54, 58, 81, 82, 86
Warrior Menzies G.M. Co., N.L. ... 54, 58, 81
Water Supply ... 11, 36, 63
Wedderburn Lease ... 32, 35
Welcome Lease ... 52, 81
W.A. Development Syndicate ... 81
W.A. Proprietary Co. ... 67
W.A. Venture Corporation ... 61
Westralia Menzies Lease ... 53, 81
West Sea Lease ... 70, 71, 81
Wilson's Lease ... 27
Witch Hazel Lease ... 23, 81
Woolgar ... 20, 62, 83, 84

Yunndaga ... 20

Zeta Lease ... 83

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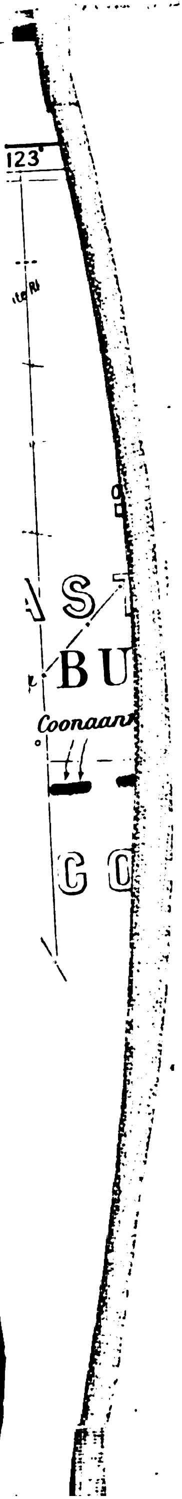

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